NI Vision

NI EVS-1464 Series User Manual

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This hardware has been tested and found to comply with the applicable regulatory requirements and limits for electromagnetic compatibility (EMC) as indicated in the hardware's Declaration of Conformity (DoC)[1]. These requirements and limits are designed to provide reasonable protection against harmful interference when the hardware is operated in the intended electromagnetic environment. In special cases, for example when either highly sensitive or noisy hardware is being used in close proximity, additional mitigation measures may have to be employed to minimize the potential for electromagnetic interference.

While this hardware is compliant with the applicable regulatory EMC requirements, there is no guarantee that interference will not occur in a particular installation. To minimize the potential for the hardware to cause interference to radio and television reception or to experience unacceptable performance degradation, install and use this hardware in strict accordance with the instructions in the hardware documentation and the DoC[1].

If this hardware does cause interference with licensed radio communications services or other nearby electronics, which can be determined by turning the hardware off and on, you are encouraged to try to correct the interference by one or more of the following measures:

- Reorient the antenna of the receiver (the device suffering interference).
- Relocate the transmitter (the device generating interference) with respect to the receiver.
- Plug the transmitter into a different outlet so that the transmitter and the receiver are on different branch circuits.

Some hardware may require the use of a metal, shielded enclosure (windowless version) to meet the EMC requirements for special EMC environments such as, for marine use or in heavy industrial areas. Refer to the hardware's user documentation and the DoC[1] for product installation requirements.

When the hardware is connected to a test object or to test leads, the system may become more sensitive to disturbances or may cause interference in the local electromagnetic environment.

Operation of this hardware in a residential area is likely to cause harmful interference. Users are required to correct the interference at their own expense or cease operation of the hardware.

Changes or modifications not expressly approved by National Instruments could void the user's right to operate the hardware under the local regulatory rules.

[1] The Declaration of Conformity (DoC) contains important EMC compliance information and instructions for the user or installer. To obtain the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

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About This Manual

This manual contains device specifications, connector pinouts, configuration information, mounting information, and answers to common questions about network, firewall, hardware, software, and power issues for National Instruments EVS-1464 series systems. Refer to *Getting Started with the NI EVS-1464* or *Getting Started with the NI EVS-1464RT* for specific installation instructions.

Conventions

The following conventions appear in this manual:

» The **»** symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.

This icon denotes a note, which alerts you to important information.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this symbol is marked on a product, refer to the product documentation for information about precautions to take.

When symbol is marked on a product, it denotes a warning advising you to take precautions to avoid electrical shock.

bold Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

italic Italic text denotes variables, emphasis, a cross-reference, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.

`monospace` Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

monospace bold Bold text in this font denotes the messages and responses that the computer automatically prints to the screen. This font also emphasizes lines of code that are different from the other examples.

Related Documentation

The following documents contain information that you may find helpful as you read this manual.

Hardware Documents

- *Getting Started with the NI EVS-1464*—Contains important safety information, and installation and configuration instructions for the NI EVS-1464. You can access this manual by navigating to **Start»All Programs»National Instruments»Vision»Documentation»NI-IMAQ IO**.
- *Getting Started with the NI EVS-1464RT*—Contains important safety information, and installation and configuration instructions for the NI EVS-1464RT. You can access this manual by navigating to **Start»All Programs»National Instruments»Vision»Documentation»NI-IMAQ IO**.

NI Vision Acquisition Software Documents

- *NI-IMAQdx Help*—Contains fundamental programming concepts for the NI-IMAQdx driver software.
- *NI-IMAQdx VI Reference Help*—Contains reference information about the LabVIEW VIs and properties for NI-IMAQdx driver software.
- *Measurement & Automation Explorer Help for NI-IMAQdx*—Describes how to configure NI-IMAQdx driver software and NI image acquisition devices using Measurement & Automation Explorer.

NI Vision Builder for Automated Inspection Documents

- *NI Vision Builder for Automated Inspection Tutorial*—Describes Vision Builder for Automated Inspection and provides step-by-step instructions for solving common visual inspection tasks, such as inspection, gauging, part presence, guidance, and counting.
- *NI Vision Builder for Automated Inspection: Configuration Help*—Contains information about using the Vision Builder for Automated Inspection Configuration Interface to create a machine vision application.
- *NI Vision Builder for Automated Inspection: Inspection Help*—Contains information about running applications created with Vision Builder for Automated Inspection in the Vision Builder Automated Inspection Interface.

LabVIEW and NI Vision Development Module Documents

- *LabVIEW Help*—Includes information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, and tools.
- *Getting Started with LabVIEW*—Use this manual as a tutorial to familiarize yourself with the LabVIEW graphical programming environment and the basic LabVIEW features you use to build data acquisition and instrument control applications.
- *Getting Started with the LabVIEW Real-Time Module*—Use this manual as a tutorial to familiarize yourself with the LabVIEW Real-Time Module and the basic Real-Time Module features you use to build real-time applications.
- *NI Vision Concepts Help*—Describes the basic concepts of image analysis, image processing, and machine vision. This document also contains in-depth discussions about imaging functions for advanced users.
- *NI Vision for LabVIEW Help*—Describes how to create machine vision and image processing applications in LabVIEW using the Vision Development Module. The help file guides you through tasks beginning with setting up your imaging system to taking measurements. It also describes how to create a real-time vision application using NI Vision with the LabVIEW Real-Time Module and contains reference information about NI Vision for LabVIEW palettes and VIs.

1

NI EVS-1464 Series Overview

This chapter contains an overview of NI EVS-1464 series systems, related camera standards, and National Instruments software.

Product Description

NI EVS-1464 series systems are small, fanless embedded vision system designed for rugged industrial applications. NI EVS-1464 series systems feature a 1.66 GHz dual core processor and a variety of industrial communication connectors that allow the NI EVS-1464 series system to communicate and integrate with a wide range of automation devices including programmable logic controllers (PLCs), human machine interfaces (HMIs), robotics, sensors, and actuators.

The NI EVS-1464 series includes the NI EVS-1464 and the NI EVS-1464RT.

- **NI EVS-1464**—Features a Windows operating system and support for DirectShow-compatible USB cameras[1]
- **NI EVS-1464RT**—Features a 1 GB solid-state drive and a real-time operating system, including real-time support for connected cameras and image processing applications

Both NI EVS-1464 series systems include IEEE 1394b[2] bilingual and GigE Vision camera interfaces. NI EVS-1464 series systems feature a 44-pin D-SUB digital I/O connector that provides TTL inputs and outputs and isolated inputs and outputs for connecting to external devices, such as lighting controllers, proximity sensors, and quadrature encoders.

NI EVS-1464 series systems include reconfigurable I/O (RIO). Behind the digital I/O of the NI EVS-1464 is an FPGA which has been preconfigured with the functionality required for most common machine vision tasks. However, if the factory configured functionality does not fulfill your requirements, the FPGA is user-configurable using the LabVIEW FPGA Module.

[1] DirectShow-compatible USB cameras require a Windows operating system, and are not supported on the NI EVS-1464RT.

[2] To connect an IEEE 1394a camera to the NI EVS-1464, you will need a 6-pin to 9-pin cable or a 6-pin to 9-pin adapter.

NI Vision Acquisition Software

NI EVS-1464 series systems ship with the latest version of NI Vision Acquisition Software, which contains all of the drivers in the NI Vision product line. With NI Vision Acquisition Software, you can quickly and easily start your applications without having to program the device at the register level.

NI Vision Acquisition Software has an extensive library of functions—such as routines for video configuration, continuous and single shot image acquisition, memory buffer allocation, trigger control, and device configuration—that you can call from the application development environment.

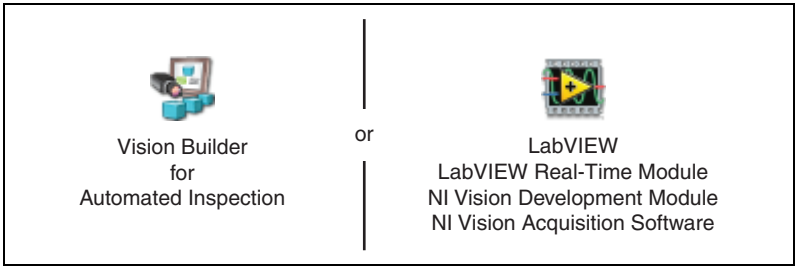
NI Vision Acquisition Software performs all functions required for acquiring and saving images but does not perform image analysis. Refer to the *Application Development Software Overview* section for information about developing image analysis applications.

The NI Vision Acquisition Software DVD contains the following software:

- **Measurement & Automation Explorer (MAX)**—Allows you to configure a NI EVS-1464 series system
- **NI-IMAQ I/O**—Controls the I/O on a NI EVS-1464 series system
- **NI-IMAQdx**—Controls any GigE Vision or DirectShow-compatible USB cameras connected to a NI EVS-1464 series system

Application Development Software Overview

Developing applications with the NI EVS-1464 device requires one of the following software options:



For installation instructions, refer to the appropriate documentation for your NI EVS-1464 series system:

- **NI EVS-1464**—Refer to the software documentation for information about installing software on the NI EVS-1464.
- **NI EVS-1464RT**—Refer to *Getting Started with the NI EVS-1464RT* for information about installing software on a development computer and configuring the NI EVS-1464RT.

The following sections describe the software options. For detailed information about individual software packages, refer to the documentation specific to the package.

Vision Builder for Automated Inspection

The NI Vision Builder for Automated Inspection (Vision Builder AI) is configurable machine vision software that you can use to prototype, benchmark, and deploy applications. Vision Builder AI does not require programming, but is scalable to powerful programming environments.

Vision Builder AI allows you to easily configure and benchmark a sequence of visual inspection steps, as well as deploy the visual inspection system for automated inspection. With Vision Builder AI, you can perform powerful visual inspection tasks and make decisions based on the results of individual tasks. You can migrate the configured inspection to LabVIEW, extending the capabilities of the applications if necessary.

LabVIEW

NI LabVIEW is a graphical programming environment for developing flexible and scalable applications. To develop machine vision applications with an NI EVS-1464 series system and LabVIEW you must have the Vision Development Module. To develop machine vision applications for the NI EVS-1464RT, you must have the LabVIEW Real-Time Module.

LabVIEW Real-Time Module

The NI LabVIEW Real-Time Module combines LabVIEW graphical programming with the power of Real-Time (RT) hardware, such as the NI EVS-1464RT, enabling you to build deterministic, real-time systems. You develop VIs in LabVIEW and deploy the VIs to RT targets. The RT target runs VIs without a user interface and offers a stable platform for real-time VIs. For more information about the LabVIEW Real-Time Module, refer to the *LabVIEW Help*.

Note The LabVIEW Real-Time Module is only required to develop applications for the NI EVS-1464RT.

NI Vision Development Module

The NI Vision Development Module is an image acquisition, processing, and analysis library of hundreds of functions for the following common machine vision tasks:

- Pattern matching
- Particle analysis
- Gauging
- Taking measurements
- Grayscale, color, and binary image display

With the NI Vision Development Module you can acquire, display, and store images as well as perform image analysis and processing. Using the NI Vision Development Module, imaging novices and experts can program the most basic or complicated image applications without knowledge of particular algorithm implementations.

NI Vision Assistant, which is included with the NI Vision Development Module, is an interactive prototyping tool for machine vision and scientific imaging developers. With Vision Assistant, you can prototype vision applications quickly and test how various vision image processing functions work. Using the Vision Assistant LabVIEW VI creation wizard, you can create LabVIEW VI block diagrams that perform the prototype you created in Vision Assistant. You can use them in LabVIEW to add functionality to the generated VI.

For information about how to use the NI Vision Development Module with the LabVIEW Real-Time Module, refer to the *NI Vision for LabVIEW Help*.

Camera Interface Overview

This section summarizes the camera interfaces that are supported by NI EVS-1464 series systems.

IEEE 1394

IEEE 1394 is a cross-platform implementation of the high-speed serial data bus—defined by the IEEE 1394-1995, IEEE 1394a-2000, and IEEE 1394b-2002 standards—that can move large amounts of data between computers and peripheral devices. It features simplified cabling using twisted pairs, hot swapping, and transfer speeds of up to 800 megabits per second. You can support up to 63 devices on the high-speed bus with IEEE 1394.

NI EVS-1464 series systems provide two direct-connect IEEE 1394b bilingual ports, which support IEEE 1394a and IEEE 1394b devices[1]. More IEEE 1394 devices can be added using IEEE 1394 hubs. NI EVS-1464 series systems can acquire images from IEEE 1394 cameras conforming to the *IIDC 1394-based Digital Camera Specification, Version 1.30* and later.

The IEEE 1394 bus provides a fixed amount of bandwidth that is shared between the two IEEE 1394 ports on the NI EVS-1464. These ports provide direct connection for up to two DCAM-compliant IEEE 1394 cameras, depending on the amount of bandwidth each camera requires. Higher frame rates and larger image sizes require a higher data transfer rate and use more bandwidth.

Acquisition Window Control

The NI EVS-1464 adheres to the *IIDC 1394-based Digital Camera Specification* and allows you to specify a particular region of active pixels and lines on a camera to acquire. In many cases, specifying a smaller acquisition window will increase the maximum frame rate of the camera. Valid acquisition windows, and their corresponding frame rates, are defined by the camera.

[1] Using an IEEE 1394a device with the NI EVS-1464 requires a 1394a-to-1394b cable or adapter.

GigE Vision

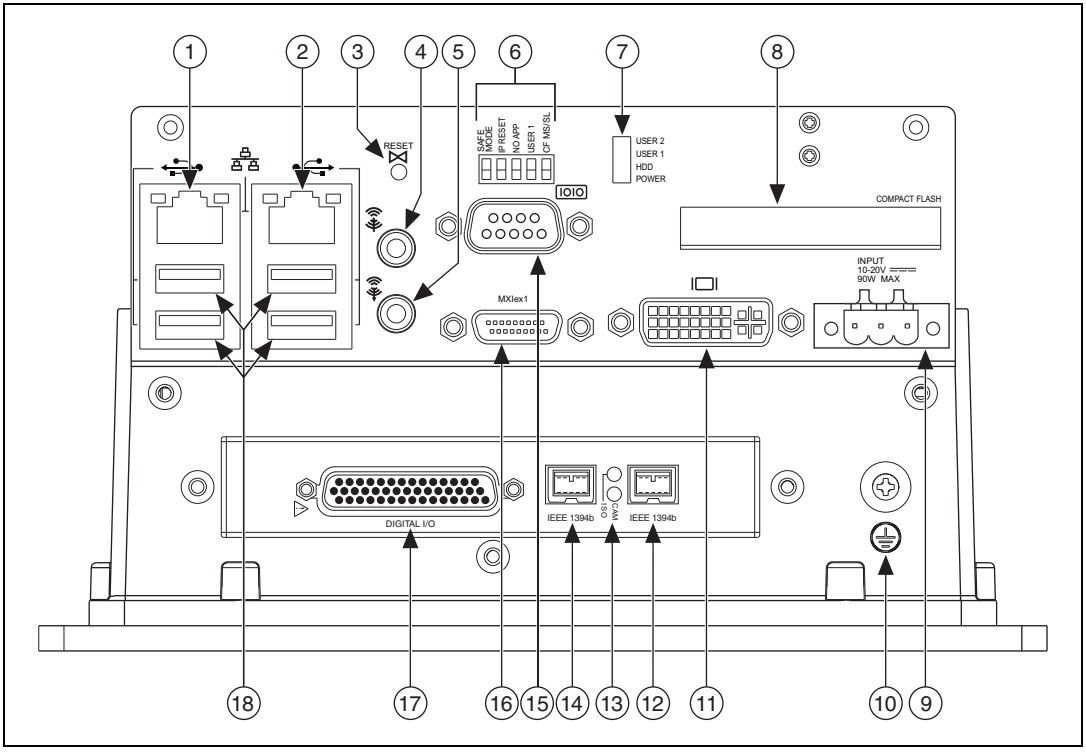
GigE Vision is a camera interface standard based on the Gigabit Ethernet communication protocol. GigE Vision cameras work with standard Gigabit Ethernet networks and hardware. Because the Gigabit Ethernet standard allows transmission of up to 1000 megabits per second, GigE Vision offers faster transmission rates than USB, USB 2, IEEE 1394a and IEEE 1394b. GigE Vision networks can acquire images from multiple cameras; however, all cameras on the network share the same bandwidth.

While Gigabit Ethernet is a standard bus technology, not all cameras with Gigabit Ethernet ports are GigE Vision compliant. In order to be GigE Vision Compliant, the camera must adhere to the protocols laid down by the GigE Vision standard and must be certified by the Automated Imaging Association (AIA). If you are unsure whether your camera supports the GigE Vision standard, look for the GigE Vision logo in the camera documentation.

2

LED Indicators, DIP Switches, and Connectors

This chapter contains information about the LED indicators, DIP switches, and I/O connectors on the front panel of a NI EVS-1464 series system. Figure 2-1 shows the front panel layout for a NI EVS-1464 series system.



1	Primary Network Connector	7	User 2/User 1/HDD/Power LEDs	14	IEEE 1394b Bilingual Connector
2	Secondary Network Connector	8	CompactFlash Slot	15	RS-232 Serial Connector (COM1)
3	Reset Switch	9	Power Supply Connector	16	MXI Express x1 Connector
4	Audio In Connector	10	Grounding Lug	17	Digital I/O Connector
5	Audio Out Connector	11	DVI-I Connector	18	USB Connectors
6	Safe Mode/IP Reset/No App/ User 1/CF Master/Slave Switches	12	IEEE 1394b Bilingual Connector		
		13	ISO/CAM Power Status LEDs		

Figure 2-1. NI EVS-1464 Connectors

LEDs and DIP Switches

This section contains descriptions of the LED indicators and DIP switches on the front panel of a NI EVS-1464 series system.

LED Indicators

The front panel of a NI EVS-1464 series system features the following indicators:

- **USER 2**—LabVIEW Real Time programmable LED
- **USER 1**—LabVIEW Real Time programmable LED
- **HDD**—Green when HDD read/write is in progress
- **POWER**—Green when powered on
- **CAM**—Green when powered on
- **ISO**—Orange when an external power supply provides power for the isolated outputs on the 44-pin D-SUB connector

DIP Switches

The front panel of a NI EVS-1464 series system features the following switches:

- **RESET**—Recessed reset switch; accessible with a ballpoint pen
- **SAFE MODE**—Runs LabVIEW Real Time in Safe Mode
- **IP RESET**—Resets the LabVIEW Real Time IP address to default
- **NO APP**—Prevents LabVIEW Real Time from running the user application on startup
- **USER 1**—LabVIEW Real Time-accessible user switch
- **CF MASTER/SLAVE**—Allows the CF slot to be either master (with no internal HDD) or slave (with internal HDD)

You can modify the behavior of some switches by adjusting BIOS settings. For more information refer to Chapter 4, *BIOS Configuration and System Recovery*.

Connectors

This section describes the connectors on the NI EVS-1464 series system, including pinouts and signal descriptions for each connector.

Table 2-1 summarizes the functions of the connections on the NI EVS-1464 series system.

Table 2-1. NI EVS-1464 I/O Overview

I/O Interface	External Connector	Description
Video	DVI-I (24-pin DSUB)	Intel GMA-950
Serial	9-pin DSUB	16550 RS-232 serial port
Ethernet	LAN (RJ45)	10/100/1000 Ethernet connection
USB (four ports)	USB 4-pin Series A stacked receptacle	Hi-Speed USB
CompactFlash	CompactFlash slot	CompactFlash expansion
MXI Express	MXI Express x1	MXI Express x1 connection
Audio	3.5 mm jack	Line-level audio in and out
Power	3-pin power connector	10–30 VDC, 70 W minimum
IEEE 1394	9-pin IEEE 1394b bilingual connector	Power and data connection to IEEE 1394 devices
Digital Input/Output	44-pin female high-density D-SUB connector	External TTL I/O, External isolated I/O, Power for isolated outputs

DVI-I Connector

Figure 2-2 shows the location and pinouts for the DVI-I connector on the NI EVS-1464 series system. Table 2-2 lists and describes the DVI-I connector signals.

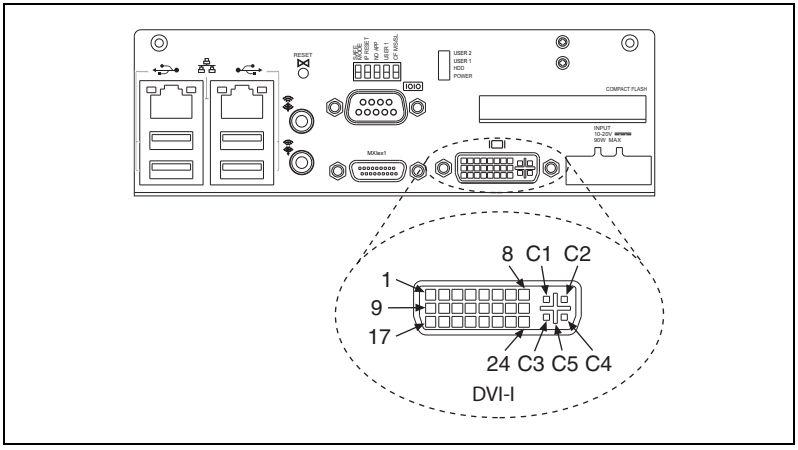


Figure 2-2. DVI-I Connector Location and Pinout

Table 2-2. DVI-I Connector Signals

Pin	Signal Name
1	TMDS Data2–
2	TMDS Data2+
3	TMDS Data2/4 Shield
4	Reserved
5	Reserved
6	DDC Clock [SCL]
7	DDC Data [SDA]
8	Analog Vertical Sync
9	TMDS Data1–
10	TMDS Data1+
11	TMDS Data1/3 Shield
12	Reserved

Table 2-2. DVI-I Connector Signals (Continued)

Pin	Signal Name
13	Reserved
14	+5 V Power
15	Ground (for +5 V)
16	Hot Plug Detect
17	TMDS Data0–
18	TMDSData0+
19	TMDS Data0/5 Shield
20	Reserved
21	Reserved
22	TMDS Clock Shield
23	TMDS Clock+
24	TMDS Clock–
C1	Analog Red
C2	Analog Green
C3	Analog Blue
C4	Analog Horizontal Sync
C5	Analog GND Return: (analog R, G, B)

RS-232 Serial Connector (COM1)

Figure 2-3 shows the location and pinouts for the RS-232 serial connector on the NI EVS-1464 series system. Table 2-3 lists and describes the RS-232 serial connector signal.

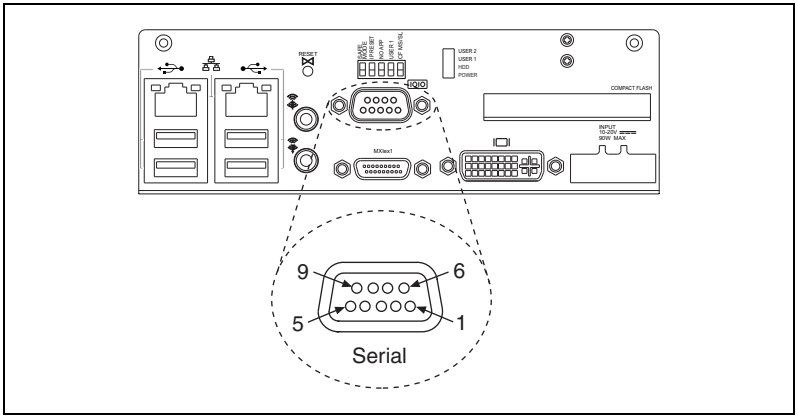


Figure 2-3. RS-232 Serial Connector Location and Pinout

Table 2-3. RS-232 Serial Connector Signals

Pin	Signal Name	Signal Description
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Ready to Send
8	CTS	Clear to Send
9	RI	Ring Indicator

Ethernet Connectors

Figure 2-4 shows the location and pinouts for the Ethernet connector on the NI EVS-1464 series system. Table 2-4 lists and describes the Ethernet connector signals.

Note When using LabVIEW Real Time, you must use the primary network connector (the port on the left) for discovery and configuration.

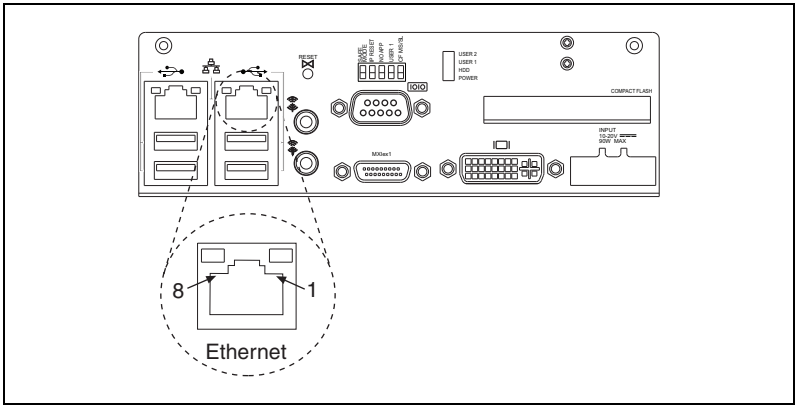


Figure 2-4. Ethernet Connector Location and Pinout

Table 2-4. Ethernet Connector Signals

Pin	Fast Ethernet	Gigabit Ethernet
1	TX+	TX_A+
2	TX–	TX_A–
3	RX+	RX_B+
4	NC	TX_C+
5	NC	TX_C–
6	RX–	RX_B–
7	NC	RX_D+
8	NC	RX_D–

Note The Ethernet controller can perform automatic crossover, eliminating the need for crossover cables.

Table 2-5. 10/100/1000 LAN Connector LED States

LED	Color	LED State	Condition
Left	Green	Off	LAN link is not established.
		On (steady state)	LAN link is established.
		On (brighter and pulsing)	The controller is communicating with another computer on the LAN.
Right	Unlit	Off	10 Mbit/s data rate is selected.
	Orange	On	100 Mbit/s data rate is selected.
	Green	On	1000 Mbit/s data rate is selected.

USB Connectors

Figure 2-5 shows the location and pinouts for the Universal Serial Bus (USB) connectors on the NI EVS-1464 series system. Table 2-6 lists and describes the USB connector signals.

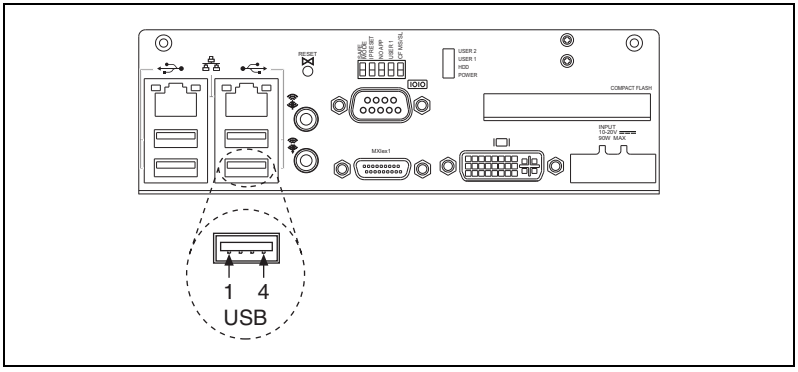


Figure 2-5. USB Connector Location and Pinout

Table 2-6. USB Connector Signals

Pin	Signal Name	Signal Description
1	VCC	Cable Power (+5 V)
2	D–	USB Data –
3	D+	USB Data +
4	GND	Ground

CompactFlash Slot

NI EVS-1464 series system are equipped with a CompactFlash slot on the front panel, which provides I/O expansion and options for removable storage.

Figure 2-6 shows the location and pinouts for the CompactFlash slot on the NI EVS-1464 series system. Table 2-7 lists and describes the CompactFlash connector signals.

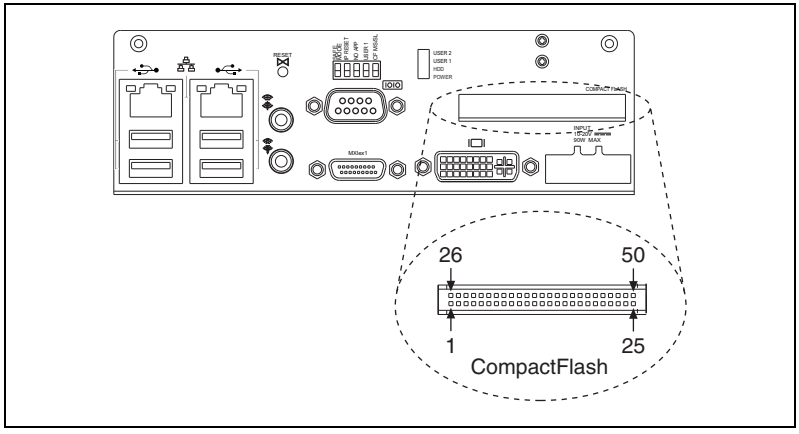


Figure 2-6. CompactFlash Slot Location and Pinout

Table 2-7. CompactFlash Connector Signals

Pin	Signal Name	Signal Description
1	GND	Ground
2	D3	Data 3
3	D4	Data 4
4	D5	Data 5
5	D6	Data 6
6	D7	Data 7
7	/CE1	Card Enable 1
8	A10	Address 10
9	/OE	Output Enable
10	A9	Address 9
11	A8	Address 8
12	A7	Address 7
13	VCC	+5 V
14	A6	Address 6
15	A5	Address 5
16	A4	Address 4
17	A3	Address 3
18	A2	Address 2
19	A1	Address 1
20	A0	Address 0
21	D0	Data 0
22	D1	Data 1
23	D2	Data 2
24	/WP:/IOIS16	Write Protect: IOIS16
25	/CD2	Card Detect 2
26	/CD1	Card Detect 1

Table 2-7. CompactFlash Connector Signals (Continued)

Pin	Signal Name	Signal Description
27	D0	Data 0
28	D0	Data 0
29	D0	Data 0
30	D0	Data 0
31	D0	Data 0
32	/CE2	Card Enable 2
33	/VS1	Refresh
34	/IORD	I/O Read
35	/IOWR	I/O Write
36	/WE	Write Enable
37	/READY:/RDY: /IREQ	Ready: Busy: Interrupt Request
38	VCC	+5 V
39	CSEL	Cable Select
40	/VS2	RFU
41	RESET	Reset
42	/WAIT	Wait
43	/INPACK	Input Acknowledge
44	/REG	Register Select
45	/BVD2:SPKR	Battery Voltage Detect 2: SPKR
46	/BVD1:STSCHG	Battery Voltage Detect 1: STSCHG
47	D8	Data 8
48	D9	Data 9
49	D10	Data 10
50	GND	Ground

MXI Express x1 Connector

Figure 2-7 shows the location and pinouts for the MXI Express x1 connector on the NI EVS-1464 series system. Table 2-8 lists and describes the cabled MXI Express x1 connector signals.

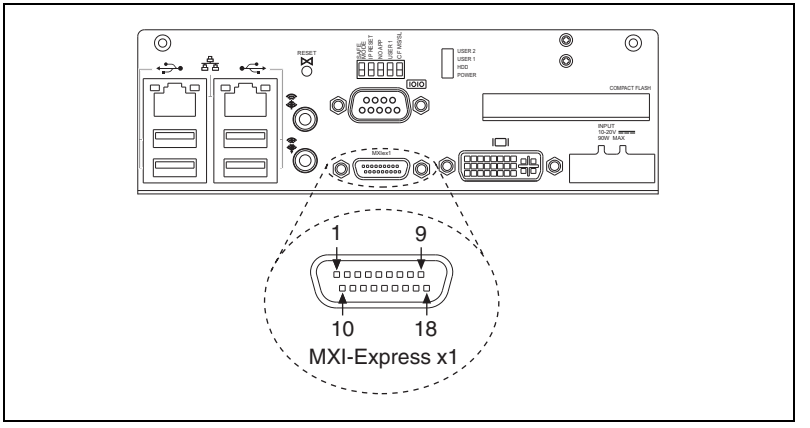


Figure 2-7. MXI Express x1 Connector Location and Pinout

Table 2-8. MXI Express x1 Connector Signals

Pin	Side B Connector		Side A Connector	
	Name	Description	Name	Description
1	+12V	+12 V Power	PRSNT#1	Hot Plug Presence Detect
2	+12V	+12 V Power	+12V	+12 V Power
3	RSVD	Reserved	+12V	+12 V Power
4	GND	Ground	GND	Ground
5	SMCLK	SMBus Clock	JTAG2	TCK
6	SMDAT	SMBus Data	JTAG3	TDI
7	GND	Ground	JTAG4	TDO
8	+3.3V	+3.3 V Power	JTAG5	TMS
9	JTAG1	TRST#	+3.3V	+3.3 V Power
10	3.3Vaux	3.3 V Power	+3.3V	+3.3 V Power
11	WAKE#	Link Reactivation	PWRGD	Power Good

Table 2-8. MXI Express x1 Connector Signals (Continued)

Pin	Side B Connector		Side A Connector	
	Name	Description	Name	Description
Mechanical Key				
12	RSVD	Reserved	GND	Ground
13	GND	Ground	REFCLK+	Reference Clock Differential Pair
14	HSOp(0)	Transmitter Lane 0, Differential Pair	REFCLK–	
15	HSOn(0)		GND	Ground
16	GND	Ground	HSIp(0)	Receiver Lane 0, Differential Pair
17	PRSNT#2	Hot Plug Detect	HSIn(0)	
18	GND	Ground	GND	Ground

Audio Connectors

Figure 2-8 shows the location and pinouts for the audio connectors on the NI EVS-1464 series system. Table 2-9 lists and describes the audio connector signals.

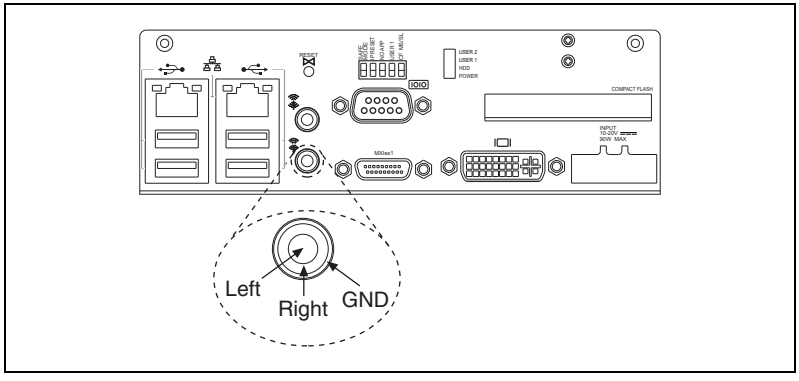


Figure 2-8. Audio Connector Location and Pinout

Table 2-9. Audio Connector Signals

Pin	Signal Name	Signal Description
Tip	Left	Left Audio Channel
Middle	Right	Right Audio Channel
Outer	GND	Ground

Power Connector

Figure 2-9 shows the location and pinouts for the power connector on the NI EVS-1464 series system. (The figure shows the front of the connector attached to the power cable, not the receptor on the NI EVS-1464 series system.) Table 2-10 lists and describes the power connector signals.

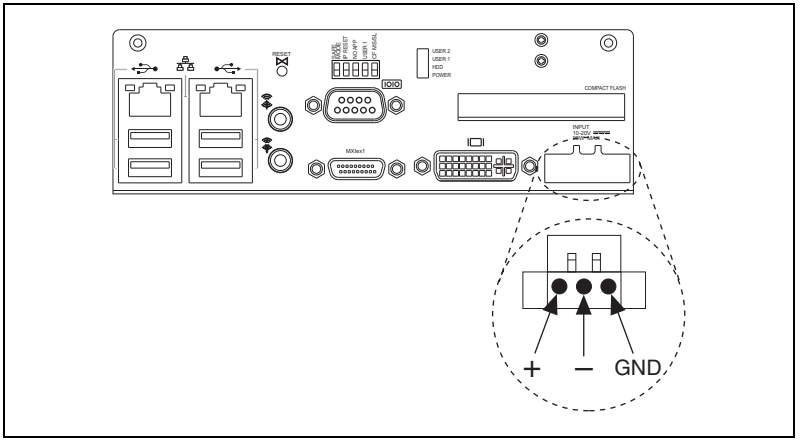


Figure 2-9. Power Connector Location and Pinout

Table 2-10. Power Connector Signals

Pin	Signal Name	Signal Description
1	+	Positive
2	–	Negative
3	GND	Chassis Ground

Earth Ground Connection

Use the grounding lug on the NI EVS-1464 series system to connect the chassis to earth ground. Connecting the grounding lug, shown in Figure 2-1, to earth ground connects the common of the main power to earth ground through the chassis of the NI EVS-1464 series system.

Note An earth ground connection does not connect C_{iso} to earth ground.

IEEE 1394b Bilingual Connector

Figure 2-10 shows the location of the IEEE 1394b bilingual connectors on the NI EVS-1464 series system.

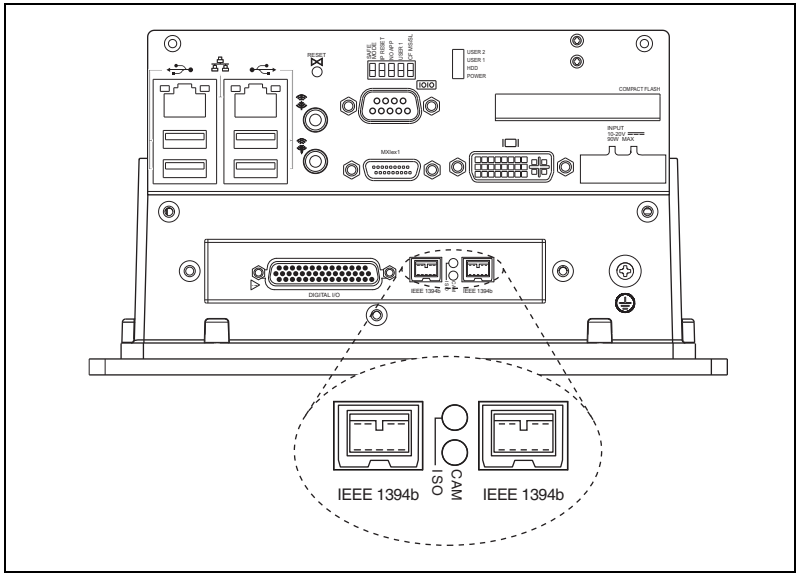


Figure 2-10. IEEE 1394b Location

The NI EVS-1464 series system provides two direct-connect IEEE 1394b bilingual connectors, which support IEEE 1394a and IEEE 1394b devices. The connectors provide a reliable, high-frequency connection between the NI EVS-1464 series system and up to two DCAM-compliant IEEE 1394 cameras. To access the IEEE 1394b connectors on the NI EVS-1464 device, use any standard 9-pin IEEE 1394 cable.

Note You can use a 6-pin to 9-pin cable or adapter with IEEE 1394a cameras to connect the cameras to the IEEE 1394b ports.

General-Purpose Digital I/O

The 44-pin D-SUB connector provides access to the general-purpose digital inputs and outputs and the isolated power supply. The general-purpose digital I/O available on this connector includes 2 TTL inputs, 10 TTL outputs, 13 isolated inputs, and 4 isolated outputs. In addition to I/O, the 44-pin D-SUB connector provides access to V_{iso} and C_{iso} for powering the isolated outputs with an external power supply. The orange LED on the front panel of the NI EVS-1464 series system illuminates when power for the isolated outputs is present. For easy connection to the digital I/O connector, use the National Instruments digital I/O cable and the NI Vision I/O Terminal Block and Prototyping Accessory.

Note The accessories available for use with the NI EVS-1464 series system do *not* provide access to all available I/O on the NI EVS-1464 series system. To access this I/O, you can create a custom cable using a standard male 44-pin D-SUB connector.

For more information about the National Instruments digital I/O cable and terminal blocks, refer to Appendix C, *Cabling Options*.

Note Isolated inputs are compatible with 5 V logic if the external circuit meets the voltage and current requirements listed in Appendix A, *Specifications*.

Caution Do *not* draw more than 100 mA from 24 V or 30 V isolated outputs. Do *not* draw more than 50 mA from 5 V isolated outputs.

Figure 2-11 illustrates the 44-pin D-SUB connector on the NI EVS-1464 series system.

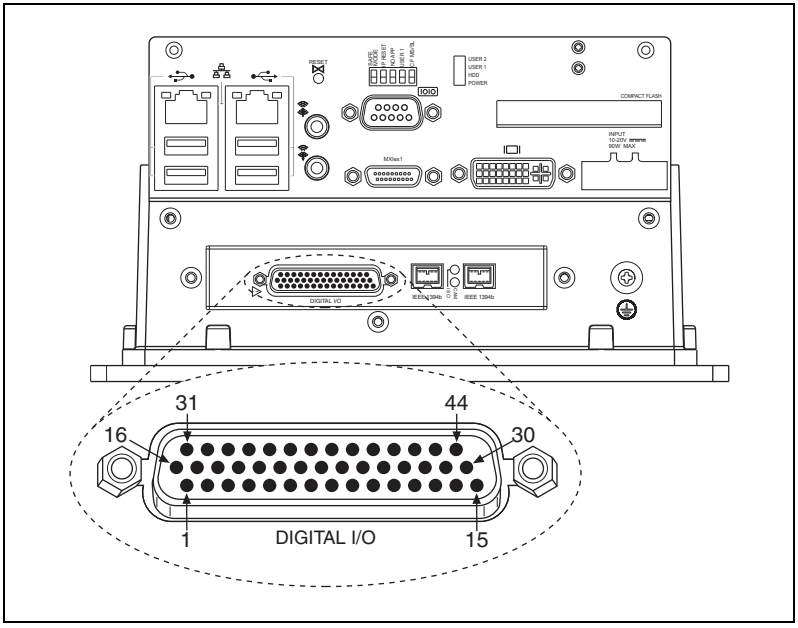


Figure 2-11. General Purpose Digital I/O (44-Pin D-SUB) Connector

Table 2-11 lists pin numbers, signal names, and signal descriptions for the 44-pin D-SUB connector on the NI EVS-1464 series system and the 37-pin terminal block.

Table 2-11. Signal Connections

44-Pin D-SUB on NI EVS-1464 Pin Number	37-Pin Terminal Block Number	Signal Name	Primary Function	Alternate Function
1	1	TTL Input 0	Pulse generator trigger input	Trigger Change Detector, General-purpose input
2	3	C	Common-mode signal of the NI EVS-1464 device main power	—

Table 2-11. Signal Connections (Continued)

44-Pin D-SUB on NI EVS-1464 Pin Number	37-Pin Terminal Block Number	Signal Name	Primary Function	Alternate Function
3	4	TTL Output 0	Watchdog timer output	General-purpose output
4	5	TTL Output 1	Pulse generator output	General-purpose output
5	6	C	Common-mode signal of the NI EVS-1464 device main power	—
6	7	TTL Output 2	Pulse generator output	General-purpose output
7	8	TTL Output 3	Pulse generator output	General-purpose output
8	6	C	Common-mode signal of the NI EVS-1464 device main power	—
9	NC	TRIG 2*/ TTL Output 8	Pulse generator output	General-purpose output
10	17	V_{iso}	Isolated power	—
11	NC	TRIG 0*/ ISO Input 12	Pulse generator trigger input	Trigger Change Detector, General-purpose input
12	19	ISO Output 0	General-purpose output	—
13	35	ISO Output 1	General-purpose output	—
14	34	C_{iso}	Isolated common-mode signal	—

Table 2-11. Signal Connections (Continued)

44-Pin D-SUB on NI EVS-1464 Pin Number	37-Pin Terminal Block Number	Signal Name	Primary Function	Alternate Function
15	9	ISO Input 0	Input port, Data(0)	—
16	2	TTL Input 1	Pulse generator trigger input	Trigger Change Detector, General-purpose input
17	3	C	Common-mode signal of the NI EVS-1464 device main power	—
18	20	TTL Output 4	Pulse generator output	General-purpose output
19	21	TTL Output 5	General-purpose output	—
20	22	C	Common-mode signal of the NI EVS-1464 device main power	—
21	23	TTL Output 6	General-purpose output	—
22	24	TTL Output 7	General-purpose output	—
23	22	C	Common-mode signal of the NI EVS-1464 device main power	—
24	NC	TRIG 1*/ TTL Output 9	Pulse generator output	General-purpose output
25	33	V_{iso}	Isolated power	—
26	34	C_{iso}	Isolated common-mode signal	—

Table 2-11. Signal Connections (Continued)

44-Pin D-SUB on NI EVS-1464 Pin Number	37-Pin Terminal Block Number	Signal Name	Primary Function	Alternate Function
27	36	ISO Output 2	General-purpose output	—
28	37	ISO Output 3	General-purpose output	—
29	12	C_{iso}	Isolated common-mode signal	—
30	10	ISO Input 1	Input port, Data(1)	—
31	11	ISO Input 2	Input port, Data(2)	—
32	13	ISO Input 3	Input port, Data(3)	—
33	16	C_{iso}	Isolated common-mode signal	—
34	14	ISO Input 4	Input port, Data(4)	—
35	15	ISO Input 5	Input port latch, Data(5)	Pulse generator trigger input
36	28	C_{iso}	Isolated common-mode signal	—
37	25	ISO Input 6	Quadrature encoder Phase A	General-purpose input
38	26	ISO Input 7	Quadrature encoder Phase B	General-purpose input
39	28	C_{iso}	Isolated common-mode signal	—
40	27	ISO Input 8	Pulse generator trigger input	Trigger Change Detector, General-purpose input

Table 2-11. Signal Connections (Continued)

44-Pin D-SUB on NI EVS-1464 Pin Number	37-Pin Terminal Block Number	Signal Name	Primary Function	Alternate Function
41	29	ISO Input 9	General-purpose input	Trigger Change Detector, General-purpose input
42	32	C_{iso}	Isolated common-mode signal	—
43	30	ISO Input 10	General-purpose input	Trigger Change Detector, General-purpose input
44	31	ISO Input 11	User shutdown	General-purpose input

* TRIG 0, TRIG 1, and TRIG 2 are not available on the 37-pin terminal block or the NI Vision I/O Terminal Block and Prototyping Accessory. If you need access to these signals, use a custom cable to access the 44-pin D-SUB connector.

3

Digital I/O Functionality

The digital I/O on a NI EVS-1464 series system is accessible through 2 TTL inputs, 10 TTL outputs, 13 isolated inputs, and 4 isolated outputs.

You can use input signals as triggers, product selection ports, or to read quadrature encoders. Uses for output signals include controlling camera reset and exposure, controlling strobe lighting, outputting inspection results, or communicating with PLCs. You can also define the functions of digital input and output signals.

For information about how to use LabVIEW to implement specific digital I/O functions, refer to the examples at `<LabVIEW>\examples\IMAQ\IMAQ IO.llb`, where `<LabVIEW>` is the location to which LabVIEW is installed.

RIO and the LabVIEW FPGA Module

Behind the digital I/O of the NI EVS-1464 series system is an FPGA which has been configured with the functionality required for most common machine vision tasks. If the factory configured functionality does not fulfill your requirements, the FPGA is user-configurable with the LabVIEW FPGA Module. National Instruments reconfigurable I/O (RIO) allows you to develop custom FPGA logic to add triggering, pulse-width modulation signals, or custom communications protocols to your machine vision application.

Using NI RIO hardware and the LabVIEW FPGA Module, you can define your hardware without in-depth knowledge of hardware design tools or hardware description languages (HDL). When the signal requirements change, the LabVIEW code can be modified and downloaded to the FPGA to change the I/O mix or type. This flexibility allows you to reuse the same hardware and software at no extra expense.

The NI EVS-1464 series system has 29 digital I/O lines with built-in functionality for communicating with external devices, such as reading quadrature encoder inputs, generating strobe pulses, and writing to or reading from digital lines.

NI EVS-1464 series systems have 15 digital input lines—13 optically isolated lines and two dedicated TTL lines. There are 14 digital output lines—four optically isolated lines and 10 dedicated TTL lines. Using these signals, you can dynamically control your lighting or cameras, synchronize with a conveyor belt, or communicate with relays that control solenoids and other actuators.

For more information about using the LabVIEW FPGA Module to implement custom FPGA logic, refer to the examples at `<LabVIEW>\examples\IMAQ\IMAQ IO FPGA.llb`. You must have the LabVIEW FPGA Module and the NI-IMAQ I/O driver installed to view these examples.

TTL Inputs and Outputs

TTL is a fast-switching 5 V digital signaling standard commonly used for applications that require high precision, such as camera triggering. TTL inputs and outputs do not require a separate power supply.

Caution Do *not* connect voltage or current sources to TTL outputs. Doing so could damage the device.

Table 3-1 summarizes the TTL inputs and outputs available on the NI EVS-1464 series system.

Table 3-1. TTL Inputs and Outputs for the NI EVS-1464 Series System

Primary Function	Input or Output	Number Available	Signal Names	NI EVS-1464 Series System 44-Pin D-SUB Pin Number	37-Pin Terminal Block Pin Number
Trigger	Input	2	TTL Input 0, General Purpose*	1	1
			TTL Input 1, General Purpose*	16	2
Timed Pulse	Output	6	TTL Output 1, Pulse 1	4	5
			TTL Output 2, Pulse 2	6	7
			TTL Output 3, Pulse 3	7	8
			TTL Output 4, Pulse 4	18	20
			TRIG 1, Pulse 5	24	—
			TRIG 2, Pulse 6	9	—

Table 3-1. TTL Inputs and Outputs for the NI EVS-1464 Series System (Continued)

Primary Function	Input or Output	Number Available	Signal Names	NI EVS-1464 Series System 44-Pin D-SUB Pin Number	37-Pin Terminal Block Pin Number
Watchdog	Output	1	TTL Output 0	3	4
General Purpose	Output	3	TTL Output 5 TTL Output 6 TTL Output 7	19 21 22	21 23 24
* TTL Input 0 and TTL Input 1 can also function as trigger change detectors.					

Isolated Inputs and Outputs

The isolated inputs and outputs on the NI EVS-1464 series system have a separate ground reference from the main NI EVS-1464 series system supply, providing an easy means to prevent ground loops that can introduce noise into a system. You can apply signals up to 30 V to the isolated inputs. The voltage swing of the isolated outputs is determined by the voltage you supply on the V_{iso} pins of the device.

Note V_{iso} can be supplied directly to the 44-pin D-SUB when using custom cabling. Alternatively, V_{iso} can be supplied directly to the 37-pin terminal block and to the NI Vision I/O Terminal Block and Prototyping Accessory with the 44-pin to 37-pin NI cable.

Note The isolated outputs have current-limiting protection circuitry. If this circuitry is tripped, you can re-enable the outputs by removing the fault and restarting your computer.

Table 3-2 summarizes the isolated inputs and outputs available on the NI EVS-1464 series system.

Table 3-2. Isolated Inputs and Outputs for the NI EVS-1464 Series System

Primary Function	Input or Output	Number Available	Signal Names	NI EVS-1464 Series System 44-Pin D-SUB Pin Number	37-Pin Terminal Block Pin Number
Trigger	Input	3	TRIG 0* ISO Input 5† ISO Input 8*	11 35 40	— 15 27
Quadrature Encoder	Input	1	ISO Input 6 ISO Input 7	37 38	25 26
External Shutdown Control	Input	1	ISO Input 11	44	31
Product Selection Port†	Input	1	ISO Input 0 ISO Input 1 ISO Input 2 ISO Input 3 ISO Input 4	15 30 31 32 34	9 10 11 13 14
General Purpose	Input	2	ISO Input 9* ISO Input 10*	41 43	29 30
General Purpose	Output	4	ISO Output 0 ISO Output 1 ISO Output 2 ISO Output 3	12 13 27 28	19 35 36 37

* TRIG 0, ISO Input 8, ISO Input 9, and ISO Input 10 can also function as trigger change detectors.

† ISO Input 5 can also function as a latch for the product selection port.

I/O for Normal Operation

The following sections describe I/O functions that are available on NI EVS-1464 series systems during normal operation.

Trigger Inputs

Trigger inputs are available from both TTL inputs and isolated inputs. You can use these trigger inputs to synchronize a NI EVS-1464 series system with an external event, such as the assertion of a signal generated by a proximity sensor or a PLC, to indicate that an inspection item is passing in front of the camera. NI EVS-1464 series systems can use this input to initiate a timed pulse for camera control, lighting control, encoder pulse counting, and result output timing. For more information about creating a timed pulse output, refer to the *Timed Pulse Output* section.

TTL Input 0, TTL Input 1, TRIG 0, ISO Input 6, ISO Input 7, ISO Input 8, and ISO Input 11 can alternatively function as general-purpose inputs. ISO Input 5 can alternatively function as a latch for the product selection port.

Timed Pulse Output

NI EVS-1464 series systems are capable of timed pulse output on six different digital outputs, which provides precise control over time-critical signals, such as camera exposure. This section describes the various uses for the timed pulse output and the parameters you can set to control these outputs.

Uses for timed pulse output include controlling camera reset and exposure, controlling strobe lighting, operating plungers on an assembly line, and communicating with PLCs. You can configure the start of the pulse output generation to occur from software or from a rising or falling edge of a trigger input.

In addition to controlling the timing of pulse output, you can also configure the polarity of the output signal, resulting in a high-true or low-true signal. Based on the polarity setting, the output signal asserts after the appropriate delay time and de-asserts after the configured pulse width. You can set the delay time in microseconds or in quadrature encoder counts from the start signal—either a hardware trigger or a software command. Width is always configured in microseconds.

Initiating a Timed Pulse

Each timed pulse generator has a trigger input that specifies whether to wait on a particular trigger input to generate the pulse or to immediately generate the pulse when software sets the pulse mode to **Start** in LabVIEW.

If the trigger input is set to **Immediate** in LabVIEW, the pulse generation occurs as soon as the pulse mode is set to **Start**. After generating a pulse, it immediately generates another pulse until the pulse generation is stopped. If the trigger input is set to one of the hardware trigger inputs, the timed pulse output waits for an assertion edge on the appropriate trigger input. After generating a pulse it waits for another trigger before generating another pulse. The assertion edge is configurable based on the trigger polarity parameter. It then generates one pulse and rearms to wait for the next trigger. In either case, the pulse output generation stops and resets if the pulse mode parameter is set to **Stop** in LabVIEW.

Figure 3-1 shows an output pulse when a trigger is selected.

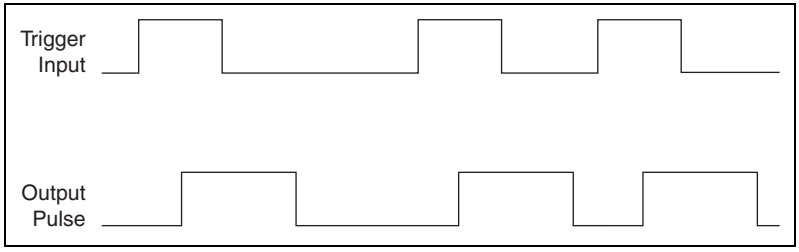


Figure 3-1. Output pulse when trigger is selected

Pulse Modes

Each pulse generator has a Start and a Stop mode. Configure the pulse generator when in Stop mode and then set it to Start mode.

Pulse Delay

Pulse delay is the amount of time between a trigger and the first (assertion) edge of an output pulse. The pulse delay is configurable in units of microseconds or quadrature encoder counts. If configured for microseconds, available values are between 1 µs and 4,294,967,295 µs, which is 4,294 seconds, or approximately 71 minutes. If the delay is configured for quadrature encoder counts, the range of choices is 0 counts to 4,294,967,295 counts.

Pulse Width

Pulse width is the amount of time between the first (assertion) edge of a pulse and the second (deassertion) edge. Pulse width is configurable only in microseconds from 1 μs to 4,294,967,295 μs.

Trigger Polarity

Each pulse generator can be individually configured for rising or falling edge triggering. Even if multiple pulse generators are using the same trigger, each can have different polarities.

Figure 3-2 shows the output of a pulse generator configured to look for a rising edge trigger and output a high pulse with a microsecond delay and width.

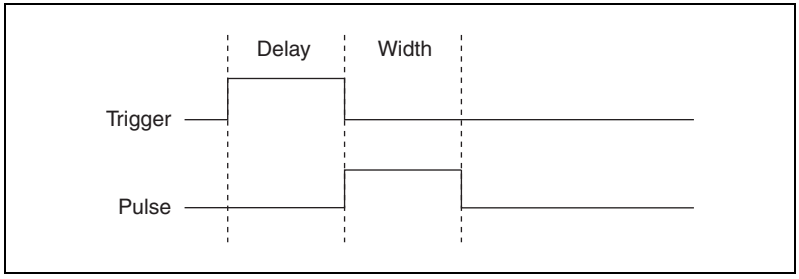


Figure 3-2. Pulse generator output when configured to detect rising edge trigger

Figure 3-3 shows how to create a high and low pulse train with a microsecond delay and width.

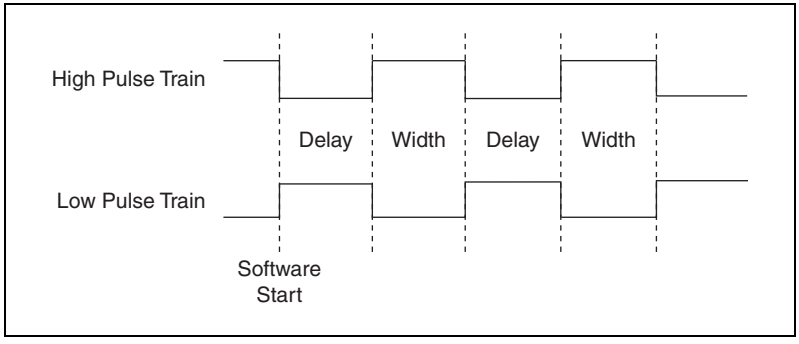


Figure 3-3. Creating a high and low pulse train with a microsecond delay and width

Trigger Change Detectors

NI EVS-1464 series systems are capable of detecting edges on various trigger lines and latching this information for future retrieval. This feature is useful for high-precision hardware-monitoring of the presence of external events without the need for software polling. You can arm for the detection of a rising edge, falling edge, or both on a supported trigger input line.

Supported trigger input lines include TTL Input 0, TTL Input 1, ISO Input 8, ISO Input 9, ISO Input 10, and TRIG 0.

Quadrature Encoder

The quadrature encoder uses ISO Input 6 for its Phase A input and ISO Input 7 for its Phase B input. Encoder speed is limited by the speed of the isolated inputs. Each isolated input can change at a maximum rate of 100 kHz, making the maximum encoder rate 400,000 counts/s.

The quadrature encoder can also be used as a timebase for the pulse generation delay.

Figure 3-4 shows a rising edge trigger and a low pulse with a quadrature encoder delay and a microsecond width.

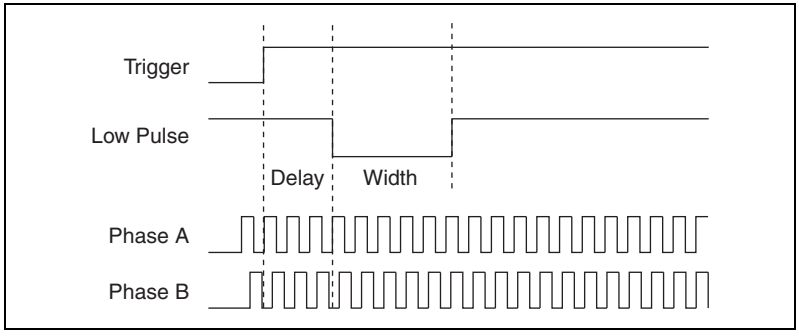


Figure 3-4. Rising edge trigger and a low pulse with a quadrature encoder delay and a microsecond width

Product Selection Port

The product selection port consists of a group of five isolated digital inputs that the software running on the NI EVS-1464 series system reads simultaneously. You can program the NI EVS-1464 series system to switch between up to 32 inspection sequences for different parts on an assembly line.

Based on the input to the product selection port, you can configure the application software to run the appropriate inspection sequence. For example, an upstream NI EVS-1464 series system programmed for part classification might drive the product selection port of a downstream system. Alternatively, a PLC with information about which part is being inspected can drive the product selection port of the NI EVS-1464 series system.

Using ISO Input 5 as a Latch

You can configure the product selection port to use ISO Input 5 as a latch. A rising edge on ISO Input 5 can latch the data into a data register on the NI EVS-1464 series system. Before each inspection, the software checks the status of the product select inputs and reads the most recent value latched into the register. If ISO Input 5 is not used as a latch, it can be used as an extra bit of data.

Note In Vision Builder AI, ISO Input 5 is always designated as a latch.

Table 3-3 lists the product selection ports.

Table 3-3. Product Selection Ports for the NI EVS-1464 Series System

Function	External Connection
Data(5), rising edge latch	ISO Input 5
Data(4)	ISO Input 4
Data(3)	ISO Input 3
Data(2)	ISO Input 2
Data(1)	ISO Input 1
Data(0)	ISO Input 0

General-Purpose I/O

General-purpose inputs and outputs are available as both TTL and isolated connections. The software running on the NI EVS-1464 series system can read the inputs and drive the outputs high or low at any time.

General-Purpose Inputs

The primary difference between general-purpose inputs and trigger inputs is that you cannot use general-purpose inputs to initiate a timed pulse generator. In an application, use the general-purpose inputs to get the status of the inputs at a given point and not to synchronize the NI EVS-1464 series system with an external event.

An example of how to use general-purpose inputs is reading the status of a general-purpose input as the first step in your inspection sequence and recording that value as part of your inspection.

General-Purpose Outputs

The primary difference between general-purpose outputs and timed pulse outputs is that the timing of general-purpose outputs is controlled by software rather than hardware. As a result, timing of general-purpose outputs changes as the inspection algorithm changes, which makes general-purpose outputs less appropriate than timed outputs for camera control, strobe light control, and other applications that require precise timing.

An example of using general-purpose outputs is driving a relay that turns on an **Inspection in Progress** light for an operator to see while the inspection sequence is running.

I/O for Fault Conditions

NI EVS-1464 series systems recognize the following fault conditions:

- External shutdown, when Shutdown mode is enabled
- Watchdog timer expiration

In the event of a fault condition, the behavior of the NI EVS-1464 series system depends on configuration settings of the software-enabled Shutdown mode. To resume operation, address the fault condition and cycle power on your computer.

Table 3-4 summarizes how user configuration affects the behavior of the NI EVS-1464 series system in the event of a fault condition.

Table 3-4. Fault Condition Behavior

Fault Condition	Shutdown Enabled	Outputs Change to User-Defined States
External Shutdown	On Off	Yes No
Watchdog	On Off	Yes No

The following sections describe each fault condition.

Shutdown

Shutdown mode is a software-enabled feature that, when activated, allows an external device to halt the NI EVS-1464 series system processing operations. Additionally, Shutdown mode allows you to specify user-defined shutdown states for all fault conditions.

When Shutdown mode is enabled and the shutdown input signal, ISO Input 11, turns off, the NI EVS-1464 series system registers an external shutdown condition. When a fault occurs, outputs operate according to user-defined shutdown states. Each TTL output is configurable to drive high, drive low, or tri-state, and each isolated output is on/off configurable.

Note For prototyping when equipment is unavailable, you can wire from V_{iso} to ISO Input 11 to simulate external equipment that indicates to the NI EVS-1464 series system to operate normally.

Watchdog Timer

The watchdog timer is a software configurable feature that can monitor software on the NI EVS-1464 series system and take action if the software is unresponsive. The millisecond counter on the watchdog timer is configurable up to 65,534 ms, in 1 ms increments, before it expires.

Configure the watchdog timer to take one of the following actions when it expires.

Caution Use the **Indicator Only** option *only* to test the watchdog timer. If software becomes unresponsive, it cannot be relied upon to send notification to the host.

- **Indicator Only**—This option sends the expiration signal back to the development machine through software. **True** indicates an expired watchdog timer. **False** indicates an unexpired watchdog timer. The expiration signal that indicates an expired watchdog timer continues to assert until the watchdog timer is disarmed. Disarming the watchdog timer resets the software indicator.
- **TTL Output 0**—This option outputs a signal on TTL Output 0. **High** indicates that the watchdog timer has expired. **Low** indicates that the watchdog timer has not expired. If the watchdog timer has expired, the expiration signal continues to assert until the watchdog timer is disarmed.
- **Shutdown**—If Shutdown mode is enabled, the outputs go to the user-defined shutdown states.

Considerations When Connecting the Digital I/O

The isolated trigger inputs on NI EVS-1464 series systems are current sinking and optically isolated. The following are considerations you need to make when connecting the digital I/O.

Wiring an Isolated Input to a Sourcing Output Device

You can wire an isolated input to a sourcing output device, as shown in the following figure. Refer to *Getting Started with the NI EVS-1464* or *Getting Started with the NI EVS-1464RT* for information about switching thresholds and current requirements.

Caution Do *not* apply a voltage greater than 30 VDC to the isolated inputs. Doing so could damage the NI EVS-1464 series system.

Figure 3-5 shows an example of connecting an isolated input to a sourcing output device.

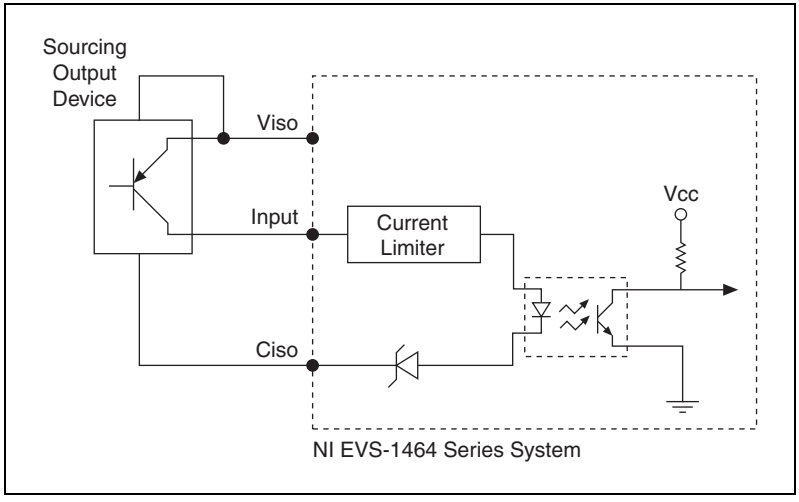


Figure 3-5. Connecting isolated input to a sourcing output device

Wiring an Isolated Output to an External Load

The digital output circuit sources current to external loads, as shown in Figure 3-6.

Caution Do *not* draw more than 100 mA from 24 V or 30 V isolated outputs. Do *not* draw more than 50 mA from 5 V isolated outputs.

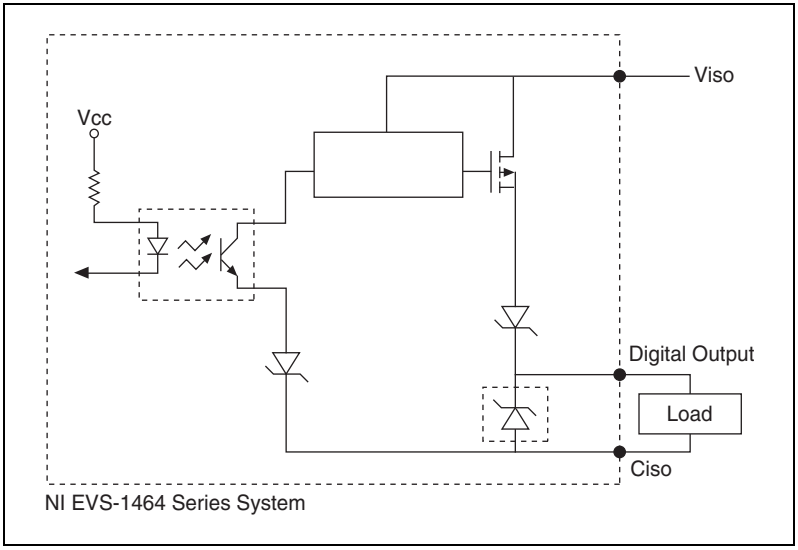


Figure 3-6. Digital output circuit sourcing current to external loads

Protecting Inductive Loads

When an inductive load, such as a relay or solenoid, is connected to an output, a large counter-electromotive force may occur at switching time due to energy stored in the inductive load. This flyback voltage can damage the outputs and the power supply.

To limit flyback voltages at the inductive load, install a flyback diode across the load. Mount the flyback diode as close to the load as possible. Use this protection method if you connect any of the isolated outputs on the NI EVS-1464 series system to an inductive load.

Figure 3-7 shows an example of using an external flyback diode to protect inductive loads.

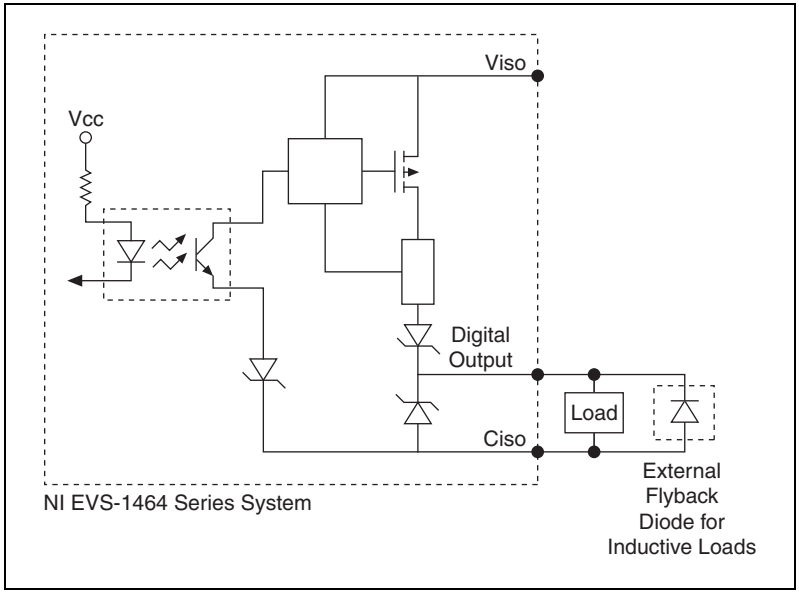


Figure 3-7. An external flyback diode protecting inductive loads

Transmission Line Effects

Transmission line effects can degrade the signals on the I/O cables and cause instability. To minimize transmission line effects, use twisted pair wires with a characteristic impedance of 118 Ω to connect external signals to the 44-pin I/O D-SUB connector.

Figure 3-8 shows connections to the 44-pin D-SUB connector that minimize transmission line effects.

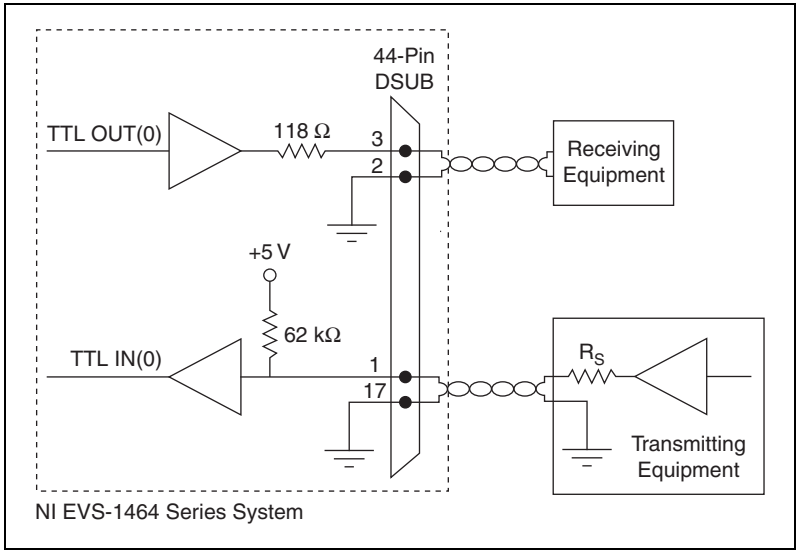


Figure 3-8. Connections to the 44-pin D-SUB connector that minimize transmission line effects

When connecting to TTL inputs on the NI EVS-1464 series system, match the output impedance of the transmitting device to the characteristic impedance of the cable. For example, if the cable characteristic impedance is 118 Ω, make R_s equal to 118 Ω, as shown in Figure 3-8.

4

BIOS Configuration and System Recovery

You can change the configuration settings for the NI EVS-1464 series system in the BIOS setup. The BIOS is the low-level interface between the hardware and PC software that configures and tests your hardware when you boot the system. The BIOS setup program includes menus for configuring settings and enabling features.

Most users do not need to use the BIOS setup program. The system ships with default settings that work well for most configurations.

Caution Changing BIOS settings may result in an unstable or unbootable system. If this happens, follow the instructions for restoring default settings in the *Clearing System CMOS* section. In general, do *not* change a setting unless you are absolutely certain what it does or National Instruments directs you to do so.

Entering BIOS Setup

To start the BIOS setup program, complete the following steps:

1. Power on or reboot the device.
2. Immediately press <Delete>.

The NI EVS-1464 series device will enter the BIOS setup program and display the **Main** menu.

Use the following keys to navigate through the BIOS setup:

- **Left, right, up, and down arrows**—Use these keys to move between different setup menus. Press <Esc> to exit a submenu. Be sure number lock is off to use the numeric keypad arrows.
- **<Enter>**—Use this key either to open a submenu or display all available settings for the highlighted configuration option.
- **<Esc>**—Use this key to return to a parent menu of a submenu or cancel an outstanding selection. At the main menu, use this key to exit the BIOS setup.

- **<+> and <–>**—Use these keys to cycle between all available settings.
- **<Tab> and <Shift> + <Tab>**—Use this key to select time and date fields. When entering time and date information, you can also use the number keys to enter the time and date directly.

Press <F1> from any root menu to display more information about navigating the BIOS setup program.

Menu items with values listed in black are changeable; menu items with values listed in gray are not changeable. A blue triangle next to a menu item indicates that the menu item contains a submenu.

The following sections describe the entries available in each BIOS menu.

Main Menu

The most commonly accessed and modified BIOS settings are in the **Main** setup menu. The **Main** setup menu includes the following settings:

- **System Time**—Changes the system time. The system time setting is stored in a battery-backed real-time clock. You can also change this setting from within Measurement & Automation Explorer (MAX) or NI Vision Builder AI.
- **System Date**—Changes the system date. The system date setting is stored in a battery-backed real-time clock. You can also change this setting from within Measurement & Automation Explorer (MAX) or NI Vision Builder AI.
- **Require Keyboard to Boot**—Specifies whether a keyboard must be connected to the NI EVS-1464 series device in order for the device to boot. To use this device in a “headless” mode, you must set this option to **Disabled**. The default value is **Enabled**.
- **NumLock**—Specifies the default behavior of the number lock setting for a connected keyboard.
- **IDE channel submenus**—Use these submenus to specify automatic detection of attached devices, master or slave selection, and access mode. Normally, you do not need to change these settings.
- **System Information submenu**—This submenu does not contain any adjustable settings. Use this submenu to view information about the system CPU, program memory, current BIOS, and any installed operating system.

Advanced Menu

This menu contains BIOS settings that normally do not require modification. If you have specific problems such as unbootable disks or resource conflicts, you may need to examine these settings.

Caution Changing settings in this menu may result in an unstable or unbootable device. If this happens, follow the procedures outlined in the *Clearing System CMOS* section to restore BIOS settings to their factory defaults.

The **Advanced** setup menu includes the following settings:

- **Reset Configuration Data**—A portion of the EEPROM on the device is designated as the Extended System Configuration Data region (ESCD). The BIOS and Plug-and-Play operating systems use this table to store the last known good configuration of system peripherals. If you experience resource conflicts or peripheral malfunction, set this setting to **Yes** to force the BIOS to recreate the ESCD on the next reboot.
- **Integrated Peripherals**—Use this setting to bring up the **Integrated Peripherals** submenu. For information about the menu items within this submenu, refer to the *Integrated Peripherals Submenu* section.
- **Quick Boot Mode**—Decreases system boot times by skipping certain tests lengthy BIOS tests that rarely fail. The default is **Enabled**.
- **Summary Screen**—Controls the display of the summary screen shown after BIOS completes its initialization, but before booting takes place. You can disable this screen in the interest of shortening device boot time. The default is **Disabled**.
- **PXE Network Boot**—This setting enables the option for booting from a network PXE server on the subnet. The default is **Disabled**.

Integrated Peripherals Submenu

Use this submenu to apply custom configurations to the front panel peripherals of an NI EVS-1464 series device. Normally, you do not need to modify these settings, as the factory default settings provide the most compatible and optimal configuration possible.

- **Serial Port A**—Enables or disables the RS-232 (COM1) connector. You can also can modify the base address and Interrupt Request Level (IRQ) of a port.
- **Legacy USB Support**—Enable this setting to boot from a USB floppy or CD-ROM. The BIOS setup screen always works with a USB keyboard, regardless of this setting.

Note Certain real-time applications may require you to disable this setting to reduce loop time jitter. When the device is configured to boot LabVIEW Real-Time, legacy USB support is automatically disabled.

- **SATA Mode**—Specifies whether the SATA controller operates in **Enhanced** or **Compatible** mode. **Enhanced** mode provides the advanced features of a SATA controller, while **Compatible** mode provides legacy backwards compatibility with standard ATA for operating systems that do not natively support SATA. The default setting is **Enhanced**.

Note When the device is configured to boot LabVIEW Real-Time, SATA Mode is automatically configured for **Compatible** mode.

- **AHCI Configuration**—Specifies whether AHCI mode is **Enabled** or **Disabled** for the SATA port. Use this setting to disable AHCI mode for non-compatible operating systems. The default setting is **Enabled**.
- **Multi-Core Processing**—Specifies whether or not the second core processor is enabled. The default setting is **Enabled**.
- **Intel® Virtualization Technology**—Allows the system to run multiple operating systems and applications in separate partitions. The default setting is **Enabled**.
- **Force IGD Primary**—Specifies how the BIOS prioritizes video controllers when external video cards are present in the system. During POST, only one device can act as the video display device. When set to **Enabled**, the BIOS allows the integrated graphics device to remain the video display device. When set to **Disabled**, the BIOS allows an external graphics card, if present, to act as the default video display device. Note that even when set to **Disabled**, the integrated graphics device still acts as the video display device if it is the only one available in the system. The default setting is **Disabled**.

PCI Menu

Normally, you do not need to modify these settings. However, other sections of this manual may indicate that modifications are necessary and may lead to unpredictable behavior.

- **APIC Routing**—This menu item is valid only for Windows XP/2000/Vista or other modern operating systems. Select **Enabled** to initialize the IOAPIC and local APIC in uniprocessor mode. Select **Disabled** to use the legacy PIC for interrupt routing. The default setting is **Enabled**.

- **PIRQx Routing**—Specifies the routing option for PCI/PCIe devices connected to PIRQx. This settings affects operating systems that do not use APIC routing. The default setting for all PIRQx options is **IRQ10**.

LabVIEW RT Menu

Use this menu to configure boot options for LabVIEW Real-Time if it is installed on the device. If you are not using LabVIEW Real-Time, you should leave these settings at default.

Note The first three settings below override the behavior of the related DIP switches on the NI EVS-1464 series device. Refer to the *LEDs and DIP Switches* section of Chapter 2, *LED Indicators, DIP Switches, and Connectors*, for more information. To use the settings from the switches, select **Use Hardware Switch** for each option.

- **Boot Configuration**—Selects whether the device should boot LabVIEW Real-Time, LabVIEW Real-Time Safe Mode, or an installed OS such as Windows XP.
- **Reset IP Address**—Specifies whether to reset the IP address of the device. Use this switch to reset the IP address to `0.0.0.0` during LabVIEW Real-Time startup. The default setting is **Use Hardware Switch**.

Note By default, the target will automatically attempt to connect to the network using DHCP. If the target is unable to initiate a DHCP connection, the target connects to the network with a link-local IP address or `169.254.x.x`.

- **Disable Startup VI**—Prevent VIs from automatically running at startup. Enable this setting if the device becomes inaccessible because of a startup VI. The default setting is **Use Hardware Switch**.
- **Video Output**—Enables normal video display output when set to **Auto**. Set to **Disable** to disable video and reduce jitter with LabVIEW Real-Time. The default setting is **Auto**.

Security Menu

Use this menu to enable BIOS security options.

- **Set User Password**—Specifies a password that must be entered to boot the system. To activate this feature, you must first specify a Supervisor password and enable the **Password on boot** feature. By default, no password is specified.
- **Set Supervisor Password**—Specifies a password that must be entered to access the BIOS setup options. By default, no password is specified.
- **Password on Boot**—Controls whether or not a password is required to boot the system. If enabled, the user must enter the User Password to boot the system. The default setting is **Disabled**.
- **Write Protect Boot Sector**—When set to **Yes**, this setting prevents modification of a hard disk boot sector via INT 13h services, which may help prevent certain computer viruses from infecting the device. This setting does not prevent boot sector modification by 32-bit operating system drivers that access the hard disk directly. The default is **No**.

Boot Menu

This screen displays the boot order of devices associated with the NI EVS-1464 series system. The BIOS proceeds down the **Boot priority order list** in search of a bootable device. Devices under the **Excluded from boot order** list will not be used for booting. If the BIOS fails to find any bootable device, the message **`Operating System Not Found`** is displayed, and the system halts.

- **PCI SCSI**—A SCSI drive (hard disk drive or CD-ROM) connected through a SCSI controller in the PXI chassis.
- **IDE HDD**—The internal hard drive.
- **USB HDD**—A USB based flash drive or hard disk drive.
- **USB CDROM**—A USB based CD-ROM drive.
- **USB FDC**—A USB based floppy disk drive.
- **PCI LAN**—A PXE Network boot device, if **PXE Network Boot** is enabled on the **Advanced** menu.

Exit Menu

The **Exit** setup menu includes all available options for exiting, saving, and loading the BIOS default configuration. You can also press <F9> to load BIOS default settings and <F10> to save changes and exit setup.

The **Exit** setup menu includes the following settings:

- **Exit Saving Changes**—Stores any changes made to BIOS settings in the battery-backed System CMOS. The setup program then exits and reboots the device.
- **Exit Discarding Changes**—Discards any changes made to BIOS settings. The setup program then exits and boots the device without rebooting first.
- **Load Setup Defaults**—Restores all BIOS settings to the factory default. This is useful if the device exhibits unpredictable behavior due to an incorrect or inappropriate BIOS setting. Notice that any nondefault settings such as boot order, passwords, and keyboardless operation are restored to their factory defaults. This may produce undesirable behavior, and in heavily customized cases, may cause the device to malfunction or fail to boot.
- **Discard Changes**—Discards any changes made to BIOS settings. Unlike **Exit Discarding Changes**, however, the BIOS setup continues to be active.
- **Save Changes**—Stores any changes made to BIOS settings in the battery-backed System CMOS. The setup program remains active, allowing further changes.

Clearing System CMOS

The NI EVS-1464 series device contains a battery-backed memory for storing BIOS configuration information.

Follow these steps to clear the CMOS contents:

1. Shut down and remove power from the NI EVS-1464 series system.
2. Turn the device so that the heatsink faces downward and the bottom plate is visible.
3. Remove the bottom plate from the chassis by removing the eight retaining screws.
4. Disconnect the 2.5 in. HDD cable, noting the pin 1 orientation.
5. Locate the jumper for clearing the CMOS contents, as shown in Figure 4-1. (For clarity, the heat spreader is not shown in the figure.)

Caution Do *not* leave the jumper on pins 1–2 for any significant length of time. Doing so decreases battery life. In addition, leaving the jumper on pins 1–2 prevents the system from booting.

6. Move the jumper from pins 2–3 to pins 1–2 as shown in Figure 4-1.
7. Wait 30 seconds and move the jumper back to pins 2–3.
8. Reconnect the 2.5 in. HDD cable, noting the pin 1 orientation.
9. Reattach the bottom plate to the chassis with the eight retaining screws.
10. Turn over the device so that the heatsink faces upward.
11. Apply power to the device.
12. Enter the BIOS to set time, date, and other parameters.

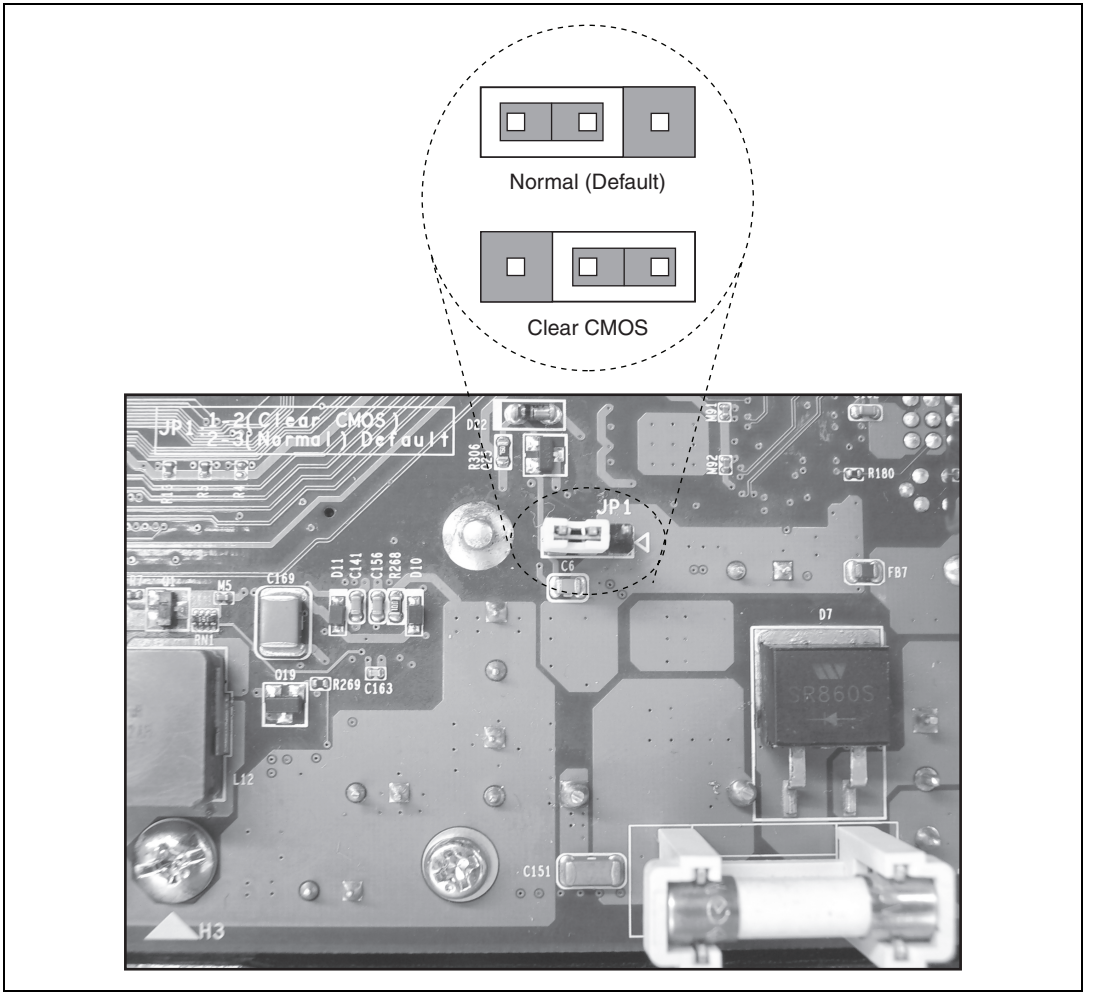


Figure 4-1. Clearing the CMOS Contents

Restoring Original Software

The following sections describe how to restore factory-installed software on an NI EVS-1464 series system.

Note Recovering factory-installed software erases the contents of your hard disk. Back up any files that you want to keep prior to the recovery.

Restoring Software on the NI EVS-1464

The NI EVS-1464 includes a factory-installed hard drive-based recovery program. Hard drive-based recovery stores a factory backup on a separate portion of your hard drive, allowing you to restore your system without additional media. To access the hard drive-based recovery program, press and hold <F4> during the boot process.

Operating system installation discs are available upon request. Contact National Instruments to request an operating system installation disc.

Restoring Software on the NI EVS-1464RT

Complete the following steps to restore factory-installed software on the NI EVS-1464RT:

1. Start the NI EVS-1464RT in safe mode. To start in safe mode, enable the **SAFE MODE** DIP switch on the front of the NI EVS-1464RT and restart the system.
2. Launch MAX.
3. In the MAX configuration tree, expand **Remote Systems**.
4. Right-click the name of the device you want to reformat and select **Format Disk**.
5. After the format completes, disable the **SAFE MODE** switch, and restart the NI EVS-1464RT.
6. Refer to *Getting Started with the NI EVS-1464RT* for information about configuring the NI EVS-1464RT device for your application.

A

Specifications

The following specifications apply NI EVS-1464 series systems. These specifications are typical at 25 °C, unless otherwise stated.

Features

CPU ..... Intel® Core Duo® L2400 (1.66 GHz dual core processor), 667 MHz FSB

On-die L2 cache ..... 2 MB

DDR2 RAM[1]

- NI EVS-1464 ..... 2 GB
- NI EVS-1464RT (P/N 194966A-031L)[2] ..... 1 GB
- NI EVS-1464RT (P/N 194966B-031L or later)[2] ..... 2 GB

Integrated hard drive

- NI EVS-1464 ..... 80 GB minimum, serial ATA
- NI EVS-1464RT ..... 1 GB minimum, parallel ATA, solid state

Integrated graphics processor ..... Intel® GMA 950

DVI-I connectors 1

10/100/1000 Ethernet connectors 2

Hi-Speed USB (2.0) connectors 4

Serial connectors (9-pin RS-232) 1

MXI Express x1 connectors 1

[1] The memory in NI EVS-1464 series systems is not field upgradeable. Contact your NI representative for upgrade options.

[2] The device part number is located on the bottom plate.

CompactFlash expansion slots.....1

Audio connectors.....1 3.5 mm line-level audio in,
1 3.5 mm line-level audio out

IEEE 1394b connectors 2

General-purpose digital I/O
connectors (44-pin D-SUB).....1

Supported camera interfaces

NI EVS-1464.....GigE Vision, IEEE 1394b, and DirectShow-compatible USB

NI EVS-1464RT.....GigE Vision, IEEE 1394b

Power Requirements

Main supply voltage .....10 VDC to 30 VDC

Power (excluding cameras) .....50 W maximum

IEEE 1394 bus power.....18 W maximum
(shared by both ports)

Caution Do *not* draw more than 100 mA from 24 V or 30 V isolated outputs. Do *not* draw more than 50 mA from 5 V isolated outputs.

Isolated supply.....5 VDC to 30 VDC

Camera interface.....Gigabit Ethernet and IEEE 1394b bilingual
(compatible with IEEE 1394a[1] cameras)

TTL Inputs and Outputs

Digital logic levels

Level	Minimum	Maximum
Input low voltage (V_{IL})	0 V	0.5 V
Input high voltage (V_{IH})	2.2 V	5 V

[1] To connect an IEEE 1394a camera to the NI EVS-1464RT, you will need a 6-pin to 9-pin cable or a 6-pin to 9-pin adapter.

Level	Minimum	Maximum
Output low voltage (V_{OL}), at 5 mA	—	0.4 V
Output high voltage (V_{OH}), at 5 mA	2.4 V	—

TTL Inputs

Number of channels 2

Maximum pulse rate..... 2 MHz

Minimum pulse detected..... 500 ns

Power-on state..... Input (high-impedance) 61.9 kΩ pull-up to 5 V

TTL Outputs

Number of channels 10

Output voltage range..... 0 V to 5 V

Maximum pulse rate..... 2 MHz

Optically Isolated Inputs and Outputs

Isolated (Current Sinking) Inputs

Number of channels 13

Input voltage range..... 0 V to 30 V

Input ON voltage..... 3.5 V to 30 V

Input OFF voltage ..... 0 V to 2 V

Turn-on current

- Typical ..... 7.1 mA
- Maximum..... 14 mA

Maximum pulse rate..... 100 kHz

Minimum pulse detected..... 10 µs

Reverse polarity protection ..... Yes, –30 V

Isolated (Current Sourcing) Outputs

Number of channels.....4

On-state voltage range .....5 V to 30 V maximum

Maximum on-state voltage drop from V .....1.2 V at 100 mA

Output current

5 V isopower.....50 mA maximum

24 V isopower.....100 mA maximum

30 V isopower.....100 mA maximum

Maximum pulse rate .....10 kHz (maximum load resistance 100 kΩ)

Minimum pulse generated .....100 µs

Reverse polarity protection.....Yes

IEEE 1394 Interface

Number of ports.....2

Speed .....100, 200, 400, or 800 Mbps

Physical

Unit dimensions.....110 mm × 200 mm × 220 mm (4.3 in. × 7.9 in. × 8.66 in.)

Weight ..... 3.76 kg (8.28 lb)

Environment

The NI EVS-1464RT device is intended for indoor use only.

Maximum altitude.....2,000 m

Pollution Degree (IEC 60664).....2

Operating Environment

Ambient temperature range ..... 0 °C to 45 °C
(IEC 60068-2-1 and IEC 60068-2-2)

Relative humidity range ..... 10% to 90% noncondensing
(IEC 60068-2-56)

Caution Clean the NI EVS-1464RT with a soft nonmetallic brush. Make sure that the device is completely dry and free from contaminants before powering-on the controller again.

Storage Environment

Ambient temperature range ..... –40 °C to 70 °C
(IEC 60068-2-1 and IEC 60068-2-2)

Relative humidity range ..... 5% to 95% noncondensing
(IEC 60068-2-56)

Shock and Vibration

Operational shock ..... 30 g peak, half-sine, 11 ms pulse
(Tested in accordance with IEC 60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)

Random vibration

Operating ..... 5 to 500 Hz, 0.3 g_{rms}
(with solid-state hard drive)

Nonoperating ..... 5 to 500 Hz, 2.4 g_{rms}
(Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN-61010-1
- UL 61010-1, CSA 61010-1

Note For UL and other safety certifications, refer to product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326 (IEC 61326): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note For the standards applied to assess the EMC of this product, refer to product label or the *Online Product Certification* section.

Note For EMC compliance, operate this product according to the documentation.

CE Compliance CE

This product meets the essential requirements of applicable European Directives as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for this product, visit `ni.com/certification`, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *NI and the Environment* Web page at ni.com/environment. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste and Electronic Equipment, visit ni.com/environment/weee.

Battery Replacement and Disposal

Battery Directive This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit ni.com/environment/batterydirective.

电子信息产品污染控制管理办法 （中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

B

Mounting Information

This appendix provides the information necessary to create a custom mount for a NI EVS-1464 series device.

Mounting the NI EVS-1464 Series Device

To maximize the cooling efficiency of the NI EVS-1464 series device, observe the following recommendations:

- Mount the NI EVS-1464 series device on a thermally conductive surface.
- Avoid static air environments.
- Mount the NI EVS-1464 series device with the heatsink facing upward. If you mount the NI EVS-1464 series device on a wall or other vertical surface, mount the device so that the heat sink fins are vertical.

Figures B-1 through B-4 provide dimensional drawings and clearance information for the NI EVS-1464 series device.

Caution Do *not* position the NI EVS-1464 series device with the heat sinks resting on any surface. Doing so may cause the NI EVS-1464 series device to overheat. Refer to Appendix A, *Specifications*, for temperature specifications.

Note You can ground the NI EVS-1464 series device to your mount by connecting a grounding wire to the grounding lug on the NI EVS-1464 series device.

Caution Your installation must meet the following space and cabling clearance requirements for optimum cooling:

- Allow 152.4 mm (6 in.) on the top of the NI EVS-1464 series device for air circulation.
- Allow 152.4 mm (6 in.) on the sides of the NI EVS-1464 series device for air circulation.
- Allow enough space in front of the NI EVS-1464 series device to connect cables.

Refer to Figure B-4 for a illustration of the space and cabling requirements for the NI EVS-1464 series device.

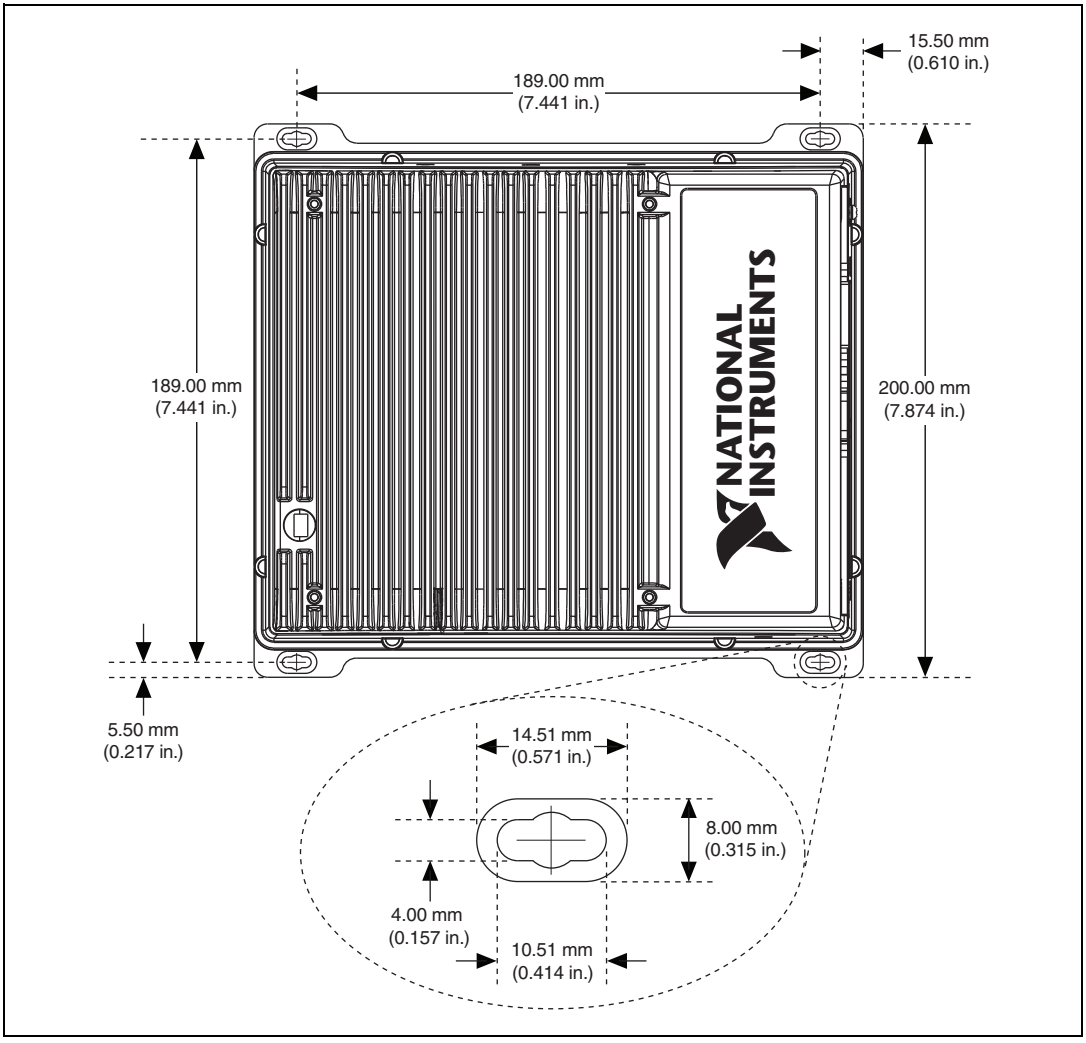


Figure B-1. Top View of the NI EVS-1464 Series Device with Dimensions

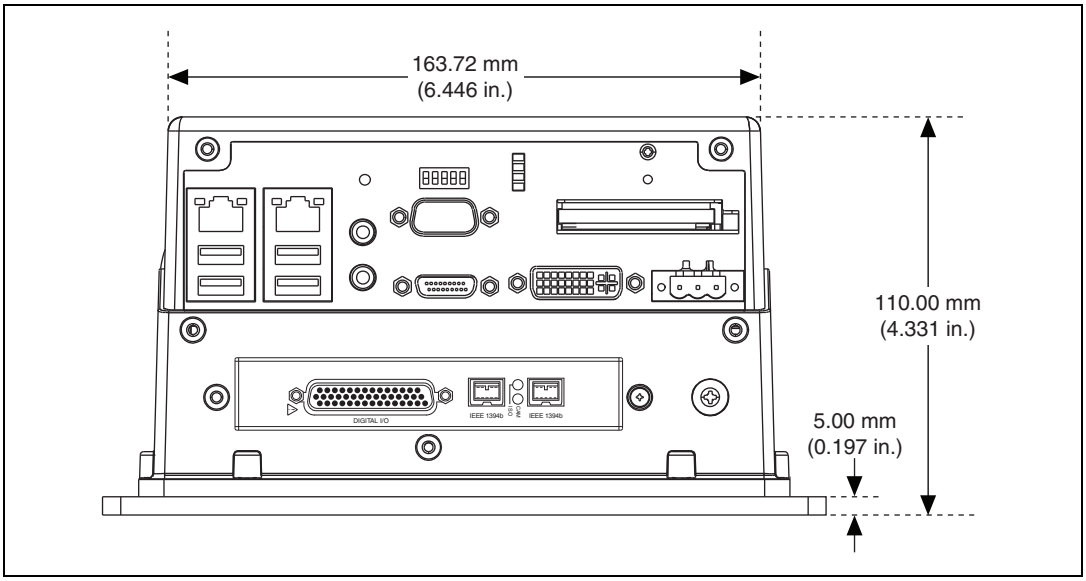


Figure B-2. Front View of the NI EVS-1464 Series Device with Dimensions

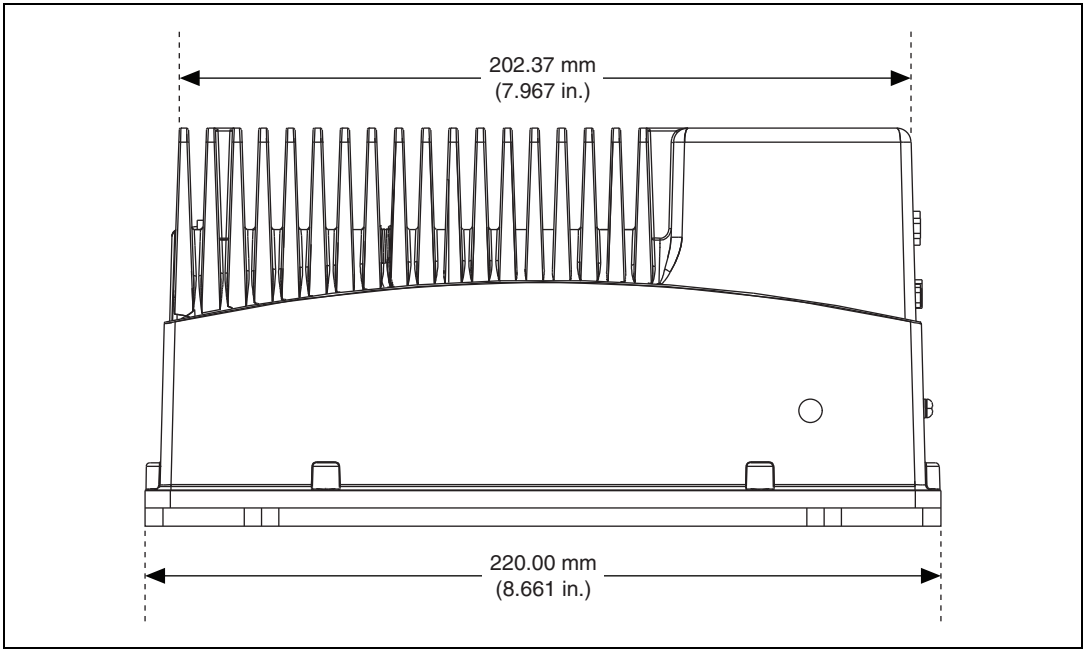


Figure B-3. Side View of the NI EVS-1464 Series Device with Dimensions

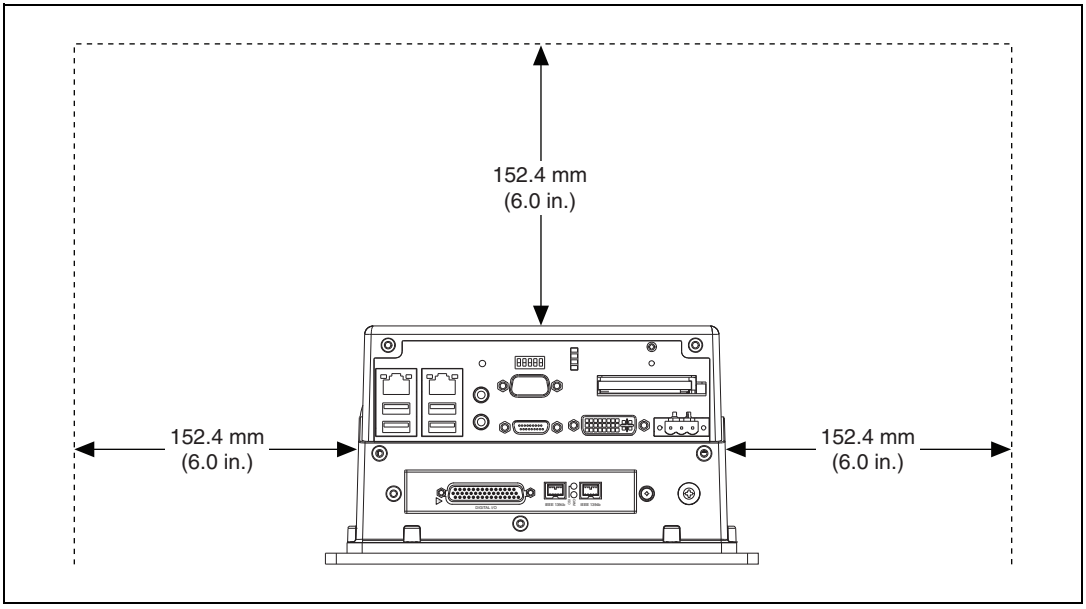


Figure B-4. Air Circulation Clearance for the NI EVS-1464 Series Device

C

Cabling Options

This appendix summarizes cable options for connecting cameras or accessing digital I/O.

IEEE 1394 Camera Cables

You can connect cameras to a NI EVS-1464 series system using standard 9-pin IEEE 1394 cables. IEEE 1394 cables provide both a data path and power to your camera. You can use a 6-pin to 9-pin cable or adapter with IEEE 1394a cameras to connect the cameras to the IEEE 1394b ports.

GigE Vision Camera Cables

Use a standard Ethernet cable to connect a GigE Vision camera to a NI EVS-1464 series system.

Note A CAT 5e or CAT 6 1000Base-T Ethernet cable is required to achieve maximum 1,000 Mbps (Gigabit) Ethernet performance. CAT 5e and CAT 6 Ethernet cables adhere to higher electrical standards required for Gigabit Ethernet communication. CAT 5 cables are not guaranteed to meet the necessary electrical requirements. While CAT 5 cables may appear to work at 1,000 Mbps in some installations, CAT 5 cables are likely to cause increased bit errors resulting in degraded or unreliable network performance.

Digital I/O Connections

National Instruments offers the following optional hardware for connecting to the digital I/O included on a NI EVS-1464 series system.

I/O Terminal Block

National Instruments offers an I/O terminal block for NI EVS-1464 series systems, which can be mounted either horizontally or vertically. The I/O terminal block breaks the signals out into easy-to-use screw terminals and comes with a cable that connects directly to the 44-pin D-SUB connector on a NI EVS-1464 series system.

NI Vision I/O Terminal Block and Prototyping Accessory

Use the NI Vision I/O Terminal Block and Prototyping Accessory to troubleshoot and prototype digital I/O applications. The NI Vision I/O Terminal Block and Prototyping Accessory provides screw terminals for easy connections and LEDs for each signal.

Note TRIG 0, TRIG 1, and TRIG 2 are not available on the 37-pin terminal block or the NI Vision I/O Terminal Block and Prototyping Accessory. If you need access to these signals, use a custom cable to access the 44-pin D-SUB connector.

D

Common Questions

This appendix lists common questions related to NI EVS-1464 series systems.

Common Questions about NI EVS-1464 Series Systems

What does it mean if the POWER LED is not lit when power is supplied to the device?

If the power supply is properly connected to the device, but the POWER LED does not light up, check that the power supply is 24 VDC ±10%, 70 W or greater, and within the specifications outlined in Appendix A, *Specifications*. Using a power supply that is not within these specifications might result in an unresponsive or unstable system and could damage the device.

How do I repair a corrupted system CMOS?

Complete the following steps to load BIOS defaults:

1. Enter the BIOS setup program as described in the *Entering BIOS Setup* section of Chapter 4, *BIOS Configuration and System Recovery*.
2. Press <F9> to load BIOS defaults, or select **Exit»Load Setup Defaults**.
3. Answer **Y** (Yes) to the verification prompt.
4. Select **Save and Exit Setup**.

As an alternative method, you can clear the CMOS. (Refer to the *Clearing System CMOS* section of Chapter 4, *BIOS Configuration and System Recovery*.)

Why does the system display a missing operating system error at startup?

The NI EVS-1464 series system was powered on or reset with all DIP switches in the **ON** position. Set the DIP switches to the **OFF** position, and reset the NI EVS-1464 series device by pressing the **RESET** button for at least two seconds.

Why does MAX or Vision Builder AI indicate that no IEEE 1394 camera is attached to the NI EVS-1464?

Verify that the combined power requirement of the cameras does not exceed the power provided on the IEEE 1394 bus.

Why does MAX or Vision Builder AI indicate that no USB camera is attached to the NI EVS-1464?

USB camera support requires a Windows operating system and a USB camera that is compatible with DirectShow. Verify that the camera is compatible with DirectShow. Verify that you have installed the camera driver. Verify that Windows detects the camera.

How do I restore factory-installed software to the hard drive of a NI EVS-1464 series system?

Refer to the *Restoring Original Software* section of Chapter 4, *BIOS Configuration and System Recovery* for information about restoring factory-installed software.

How do I install an operating system?

NI EVS-1464 series systems include a preinstalled operating system. In some cases, you may want to install a different operating system.

NI EVS-1464 series systems support installing Windows Vista/XP from a USB CD-ROM. However, many other operating systems do not support installation from a USB CD-ROM. For example, Windows 2000 aborts during the install process, because it does not include drivers for a USB CD-ROM device.

How do I upgrade the device RAM?

The memory in the NI EVS-1464 series system is not field upgradeable. Contact your NI representative for upgrade options.

How do I install a CompactFlash card?

Follow these steps to install a CompactFlash card:

1. Power down the NI EVS-1464 series system.
2. Remove the locking screw and raise the CompactFlash slot cover door.
3. Hold the card so the top side is facing up.

4. Insert the card until it is completely seated in its connector. (The ejector button protrudes from the unit when the CompactFlash card is correctly seated.)

Note If you encounter too much resistance, do not force the card. Check the card orientation and try again.

5. Lower the cover door and replace the locking screw. This cover prevents inadvertent CompactFlash card ejection.

When running Windows, the NI EVS-1464 automatically recognizes IDE-based CompactFlash memory cards and allocates them a drive letter. The CompactFlash card may need to be formatted FAT32 before the drive can be accessed. The unit may need powering off and on for the CompactFlash Card to be visible to the operating system.

Caution Do *not* insert or remove the CompactFlash card while the system is powered on. Doing so may cause data loss, and in some cases the drive may need reformatting.

Third-party cards may require additional drivers. Contact your CompactFlash vendor for more information.

Caution The CompactFlash interface is ESD sensitive. An electrostatic shock to the CompactFlash module while it is inserted may cause the device to lock up or reboot, or data loss on a CompactFlash memory card.

How do I remove a CompactFlash card?

Follow these steps to remove a CompactFlash card:

1. Power down the NI EVS-1464 series system.
2. Remove the locking screw and raise the CompactFlash slot door cover.
3. Push the protruding ejector button. The card should slide forward.

Note If you encounter too much resistance when pushing the ejector button, do not force the card. Check the card slot for obstructions and try again.

4. Remove the card from the slot.
5. Lower the cover door and replace the locking screw.

Common Questions about the NI EVS-1464RT

Why does nothing appear on a monitor connected to the NI EVS-1464RT?

If the POWER LED is lit, disconnect power from the NI EVS-1464RT and reconnect the monitor. You must connect all monitors before the NI EVS-1464RT boots. The NI EVS-1464RT does not have an on or off switch, and boots immediately when power is supplied to it.

How do I disable a runaway startup application on the NI EVS-1464RT?

If a runaway startup application causes the NI EVS-1464RT device to become unresponsive, power off the NI EVS-1464RT device and then restart it with either the **NO APP** switch or the **SAFE MODE** switch in the **ON** position. Restarting the NI EVS-1464RT device with the **NO APP** switch enabled prevents any VIs from running at startup. Restarting with the **SAFE MODE** switch enabled starts the NI EVS-1464RT device in safe mode and does not launch the embedded LabVIEW Real-Time engine.

Why is my NI EVS-1464RT device not listed as a target in MAX or in Vision Builder AI?

- Verify that there is power to the NI EVS-1464RT device and that both the NI EVS-1464RT device and the development computer are properly connected to the network. The POWER LED should be lit. When you click **Browse**, the **ACT/LINK** LED on the ethernet port should flash to indicate that communications are taking place.
- Certain network devices, such as switches and routers, may filter out the directed UDP broadcast packets the development computer uses to communicate with unconfigured NI EVS-1464RT devices, even if these devices are on the same subnet. You can test this by directly connecting the development computer and the NI EVS-1464RT. If the NI EVS-1464RT device appears in the software using this configuration, but not when connected to the larger network, the network is not properly communicating with the NI EVS-1464RT device. The NI EVS-1464RT uses the ports listed in Table D-1.

Table D-1. TCP/UDP Ports Used by the NI EVS-1464RT

Port	Type	Details
3580	TCP/UDP	Reserved as nati-svrloc (NAT-ServiceLocator). Used by Measurement & Automation Explorer (MAX) to locate remote targets.
7749	TCP	Used for remote image display (not reserved).
7750	TCP	Used for NI-IMAQ remote configuration (not reserved).
3363	TCP/UDP	Reserved as nati-vi-server (NATI VI Server). Used by Vision Builder for Automated Inspection to configure a remote NI EVS-1464RT.

If your firewall is controlled remotely or you are unsure about configuring the firewall, contact your network administrator.

- The NI EVS-1464RT device may have been configured on another network and then moved to the current network. Reconfigure the NI EVS-1464RT device on the current network.
- The grade of cable you are using may be insufficient for the speed of your network.
- Another device on the network is using the IP address assigned to the NI EVS-1464RT device. Reconfigure the NI EVS-1464RT device to use an available static IP address.
- The DIP switch settings on the NI EVS-1464RT device may be invalid, such as all switches set to the **ON** position. Change the DIP switch settings and reset the NI EVS-1464RT device by pressing the **RESET** button on the NI EVS-1464RT device for at least two seconds.

Why does MAX or Vision Builder AI report that no software is installed to the NI EVS-1464RT?

Install application and driver software on the NI EVS-1464RT device. Refer to *Getting Started with the NI EVS-1464RT* for installation instructions.

How do I format the NI EVS-1464RT?

Refer to the *Restoring Original Software* section of Chapter 4, *BIOS Configuration and System Recovery* for information about restoring the NI EVS-1464RT device to its original state.

E

Technical Support and Professional Services

Visit the following sections of the award-winning National Instruments Web site at ni.com for technical support and professional services:

- **Support**—Technical support at ni.com/support includes the following resources:
  - **Self-Help Technical Resources**—For answers and solutions, visit ni.com/support for software drivers and updates, a searchable KnowledgeBase, product manuals, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on. Registered users also receive access to the NI Discussion Forums at ni.com/forums. NI Applications Engineers make sure every question submitted online receives an answer.
  - **Standard Service Program Membership**—This program entitles members to direct access to NI Applications Engineers via phone and email for one-to-one technical support as well as exclusive access to on demand training modules via the Services Resource Center. NI offers complementary membership for a full year after purchase, after which you may renew to continue your benefits.

    For information about other technical support options in your area, visit ni.com/services, or contact your local office at ni.com/contact.
- **Training and Certification**—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. You also can register for instructor-led, hands-on courses at locations around the world.
- **System Integration**—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.

- **Declaration of Conformity (DoC)**—A DoC is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting `ni.com/certification`.

If you searched `ni.com` and could not find the answers you need, contact your local office or NI corporate headquarters. Phone numbers for our worldwide offices are listed at the front of this manual. You also can visit the Worldwide Offices section of `ni.com/niglobal` to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Glossary

Symbol	Prefix	Value
n	nano	10^{-9}
µ	micro	10^{-6}
m	milli	10^{-3}
k	kilo	10^{3}
M	mega	10^{6}
G	giga	10^{9}
T	tera	10^{12}

Symbols

°	Degrees.
Ω	Ohms.
%	Percent.

A

A	Amperes.
acquisition window	The image size specific to a video standard or camera resolution.
address	Character code that identifies a specific location (or series of locations) in memory.

B

B	Bytes.
backplane	An assembly, typically a printed circuit board, with connectors and signal paths that bus the connector pins.
bandwidth	The range of frequencies present in a signal, or the range of frequencies to which a measuring device can respond.
BIOS	Basic Input/Output System—BIOS functions are the fundamental level of any PC or compatible computer. BIOS functions embody the basic operations needed for successful use of the computer's hardware resources.
bus	The group of conductors that interconnect individual circuitry in a computer, such as the PCI bus; typically the expansion vehicle to which I/O or other devices are connected.

C

C	Celsius.
CMOS	Complementary Metal Oxide Semiconductor—A type of integrated circuit.
Controller	An embedded computer module which configures and accesses a series of devices connected to a chassis backplane.
current	The rate of flow of electric charge measured in amperes.

D

D-SUB	An I/O connector type.
DC	Direct Current.
DCAM	Digital camera.
DCAM-compliant	Cameras that comply with the *IIDC 1394-based Digital Camera Specification*, Version 1.30.
DIP switch	Dual Inline Package switch.

driver	Software that controls a specific hardware device such as an image acquisition device.
DVI-I	Direct Video Interface, Integrated—A video technology enabling the use of both analog and digital video signals.

E

EEPROM	Electronically Erasable Programmable Read Only Memory.
EMC	Electromagnetic Compatibility.
EMI	Electromagnetic interference.
exposure	The amount of time that light reaches the image sensor.
external trigger	A voltage pulse from an external source that triggers an event such as A/D conversion.

F

falling edge	An edge trigger occurs when the trigger signal passes through a specified threshold. A slope that is negative to the trigger is specified as the falling edge.
FCC	Federal Communications Commission.
FPGA	Field-programmable gate array. An FPGA is a semi-conductor device which contains a large quantity of gates (logic devices), which are not interconnected, and whose function is determined by a wiring list, which is downloaded to the FPGA. The wiring list determines how the gates are interconnected, and this interconnection is performed dynamically by turning semiconductor switches on or off to enable the different connections.
frame	A complete image; in interlaced formats, a frame is composed of two fields.

G

g	Grams.
g_{rms}	A measure of random vibration—The root mean square of acceleration levels in a random vibration test profile.
Gigabit Ethernet	Describes technologies which transmit Ethernet packets at a rate of a gigabit per second.
GigE Vision	A camera interface standard developed using the Gigabit Ethernet communication protocol.

H

HDL	Hardware description language. An example of an HDL is VHDL—a language used to design digital circuitry.
hot swapping	The act of removing or swapping a device when power is applied to it.
Hz	Hertz—Cycles per second.

I

I/O	Input/output—The techniques, media, and devices used to achieve communication between machines and users.
IDE	Integrated Drive Electronics—Hard disk and built-in controller.
IEEE	Institute of Electrical and Electronics Engineers.
IIDC	IEEE 1394 Trade Association Instrumentation and Industrial Control Working Group, Digital Camera Sub Working Group.
in.	Inches.
instrument driver	A set of routines designed to control a specific instrument or family of instruments, and any necessary related files for LabWindows™/CVI™ or LabVIEW.
interrupt	A means for a device to request service from another device.
interrupt level	The relative priority at which a device can interrupt.

IRQ	Interrupt request signal.
isolated	A signal which has no electrical connection to the overall system power.

K

kB	Kilobytes of memory.

L

LAN	Local Area Network—Communications network that serves users within a confined geographical area. It is made up of servers, workstations, a network operating system, and a communications link.
LED	Light-emitting diode.

M

m	Meters.
MAC	Media access control. The MAC address uniquely identifies each unit connected to a network.
master	A functional part of a PXI device that initiates data transfers on the PXI backplane. A transfer can be either a read or a write.
MAX	Measurement & Automation Explorer. The National Instruments Windows-based graphical configuration utility you can use to configure NI software and hardware, execute system diagnostics, add new channels and interfaces, and view the devices and instruments you have connected to your computer. MAX is installed on the desktop during the National Instruments driver software installation.
MB	Megabytes of memory.

N

NI-IMAQ I/O	Driver software that provides functions to control digital I/O on National Instruments hardware.
NI-IMAQdx	Driver software for National Instruments IEEE 1394 and Gigabit Ethernet interface devices.

P

PCI	Peripheral Component Interconnect—The PCI bus is a high-performance 32-bit or 64-bit bus with multiplexed address and data lines.
PCIe	Peripheral Component Interconnect Express—A faster, serialized version of the PCI bus.
peripheral	Any hardware device connected to a computer, such as a monitor, keyboard, printer, plotter, disk or tape drive, graphics tablet, scanner, mouse, and so on.
pixel	The fundamental picture element in a digital image. The smallest resolvable rectangular area of an image, either on a screen or stored in memory. Each pixel has its own brightness and color, usually represented as red, green, and blue intensities.
PLC	Programmable Logic Controller. An industrial computer used for factory automation, process control, and manufacturing systems.
POST	Power On Self Test.
proximity sensor	Optical sensor which toggles an electrical signal when an object passes near it.

Q

quadrature encoder	An encoding technique for a rotating device where two tracks of information are placed on the device, with the signals on the tracks offset by 90 degrees from each other. This makes it possible to detect the direction of the motion.

R

RAM	Random Access Memory—the computer's primary workspace.
real time	A property of an event or system in which data is processed as it is acquired instead of being accumulated and processed at a later time.
resource	Hardware settings used by devices in a computer system, including ISA interrupt level, DMA channel, and I/O address.
RIO	Reconfigurable inputs and outputs.
rising edge	An edge trigger occurs when the trigger signal passes through a specified threshold. A slope that is positive to the trigger is specified as the rising edge.
RS-232	Standard electrical interface for serial data communications.

S

s	Seconds.
SRAM	Static RAM—A memory chip that requires power to hold its content. It does not require refresh circuitry as a dynamic RAM chip, but it does take up more space and uses more power.
subnet	A set of systems whose IP addresses are configured such that they can communicate directly with one another. Data will not flow through an intermediate router.

T

TCP	Transmission Control Protocol. A set of standard protocols for communicating across a single network or interconnected set of networks. TCP is for high-reliability transmissions.
transfer rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and setup operations; the maximum rate at which the hardware can operate.

trigger	Any event that causes or starts some form of data capture.
TTL	Transistor-transistor logic. A digital circuit composed of bipolar transistors wired in a certain manner. A typical medium-speed digital technology. Nominal TTL logic levels are 0 and 5 V.

U

UDP	User Datagram Protocol. A set of standard protocols for communicating across a single network or interconnected set of networks. UDP is for low-overhead transmissions.
USB	Universal Serial Bus.

V

V	Volts.
VDC	Volts direct current.
VGA	Video Graphics Array—The minimum video display standard for all PCs.
voltage	The electromotive force.

W

W	Watts.

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